FEMA 209:180421

FLOOD INSURANCE STUDY

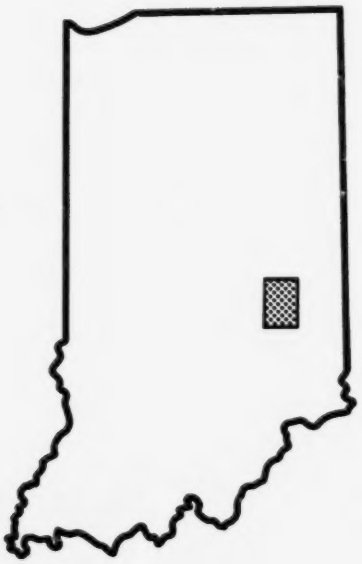
ORIGINAL

COMPLETED

103

COUNTY OF RUSH, INDIANA

UNINCORPORATED AREAS



JUNE 1, 1982

Federal Emergency Management Agency

COMMUNITY NUMBER - 180421

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Flood Boundary and Floodway Map Index
Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

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FLOOD INSURANCE STUDY

COUNTY OF RUSH, INDIANA
UNINCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Unincorporated Areas of the County of Rush, Indiana, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Rush County to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 44 CFR, 60.3 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Snell Environmental Group, Inc. for the Federal Emergency Management Agency, under Contract No. H-4777. This study was completed in December 1980.

1.3 Coordination

Streams requiring detailed study were identified at a meeting attended by representatives of the Study Contractor, FEMA, the Indiana Department of Natural Resources (IDNR) and representatives of Rush County in April 1978.

Discussion and data on historic floods were coordinated with both the IDNR and the U.S. Geological Survey (USGS) in Indianapolis, Indiana. Precipitation data for historic floods were obtained from the National Climatic Center in Asheville, North Carolina. Results of the hydrologic analyses were coordinated by the IDNR with the USGS, the U.S. Army Corps of Engineers (COE) and the Soil Conservation Service (SCS). Flood elevations and floodway delineation were coordinated with the IDNR.

On December 8, 1981, the results of the work by the Study Contractor were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Rush County, Indiana. The area of study is shown on the Vicinity Map (Figure 1).

The areas studied by detailed methods were selected with priority given to all known flood hazard areas, and areas of projected development or proposed construction through December 1985.

Approximate methods of analysis were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to and agreed upon by FEMA and Rush County.

The limits of detailed and approximate studies in Rush County were determined by FEMA and the IDNR with community and Study Contractor consultation at the meeting in April 1978.

The following streams were studied in detail:

STREAM	FROM	TO	LENGTH IN MILES
Flatrock River	County Road 350 South	County Road 300 North	10.7
Big Blue River	Western county line	Northern county line	9.7
Six Mile Creek	Western county line	Northern county line	9.2
Charlottes Brook	Mouth	Northern county line	1.9
Goose Creek	Mouth	Northern county line	3.2
Three Mile Creek	Mouth	2,900 feet upstream of County Road 250 West	6.0

The following streams were studied by approximate methods: Flatrock River; Little Flatrock River; Hurricane Creek; Bob Creek; Tributary to Bob Creek; North Branch Clifty Creek; Lick Creek; Conns Creek; Mud Creek; Ben Davis Creek; Turkey Creek; Shaukatauk Creek; Shawnee Creek; Wikoff Ditch; Miles Creek; Buck Creek and Little Blue River.

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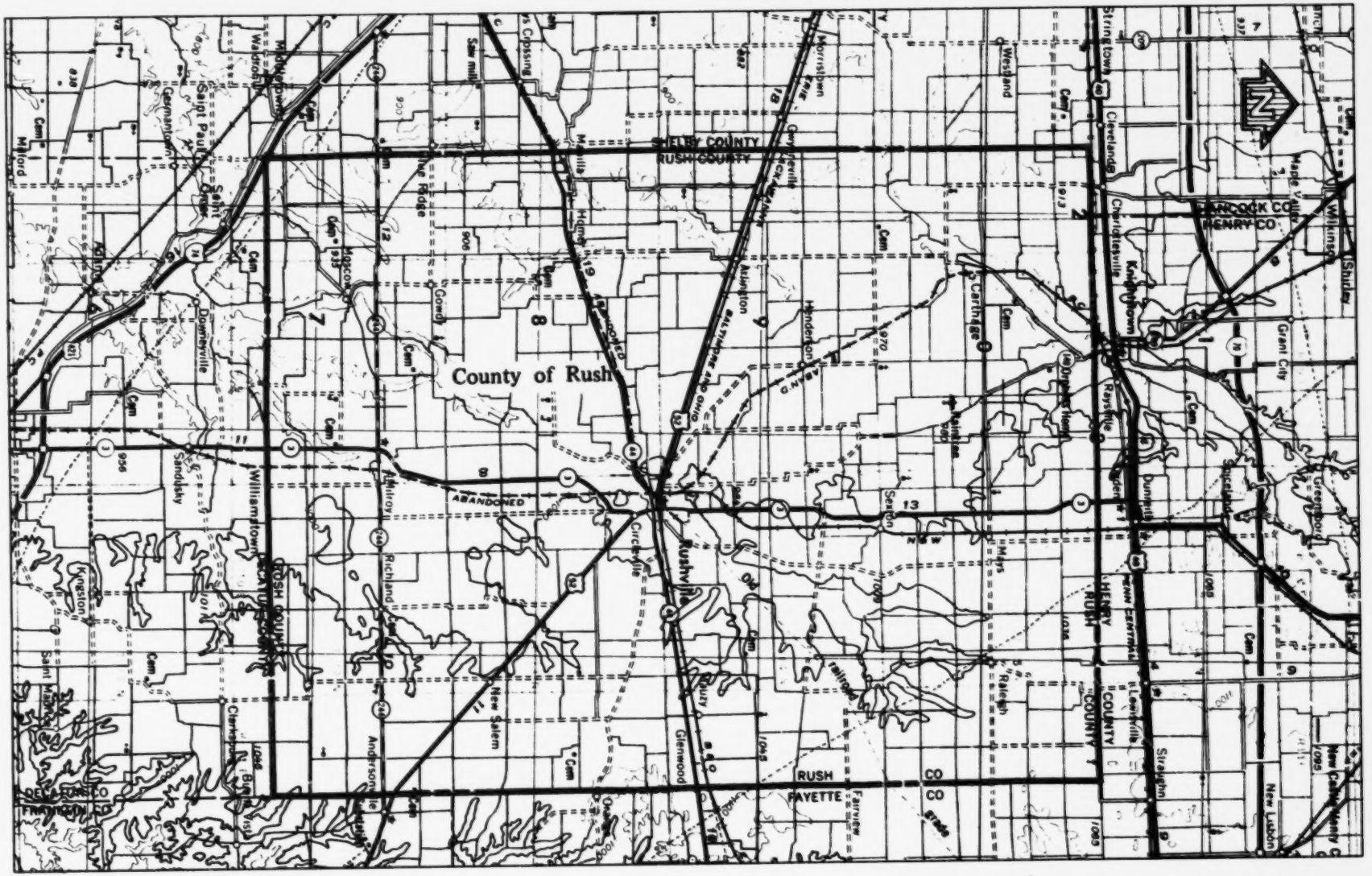

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

2.2 Community Description

Rush County, located in east-central Indiana, contains a total land area of 409 square miles. Rushville, approximately 40 miles southeast of Indianapolis is the largest city within Rush County. In 1976, the population of Rush County was 20,400 while Rushville recorded a population of 6,701 (Reference 1). The Town of Carthage is the only other unincorporated community within Rush County. Rush County is bordered on the north by Henry County, on the east by Fayette and Franklin Counties, on the south by Decatur County, and on the west by Shelby and Hancock Counties.

The climate in central Indiana is classified as continental, primarily influenced by eastward moving masses of cold polar air from the north and warm gulf air from the south. Mean monthly temperatures range from 30.7 degrees Fahrenheit (F.) in January to 75.9 degrees F. in July. Average annual precipitation of the region is 39.1 inches with slightly higher amounts occurring in the spring and early summer than the remainder of the year (Reference 1).

Rush County is characterized by gently rolling to nearly flat topography. Approximately 90 per cent of the county is agricultural land. Four per cent of the county has been developed.

Streamflow in Rush County is drained in a northeast to southwest direction. The major streams in the county are the Flatrock River, the Little Flatrock River, the Big Blue River and the Little Blue River. The Flatrock River with its headwaters in Henry County is the longest river in Rush County flowing 25.9 miles in a southwest direction. The river has a drainage area of 50 square miles at the northern county line where it enters Rush County and a drainage area of 215 square miles at the southern county line. The Little Flatrock River has its headwaters in southeast Rush County. It flows southwest into Decatur County and has a drainage area of 47.5 square miles at the southern Rush County line. The Big Blue River begins in Henry County and flows 9.7 miles through northwest Rush County. At the western corporate limit, the Big Blue River has a drainage area of 194 square miles. The Little Blue River has a drainage area of 66.1 square miles at the western corporate limit and also begins in Henry County. Six Mile Creek flows southwesterly from Henry County into Hancock County where it winds back and forth between Rush County and Hancock County before finally emptying into the Big Blue River. Charlottes Brook is a small tributary to Six Mile Creek in the northwest corner of Rush County. Goose Creek and Three Mile Creek flow into the Big Blue River near Carthage in Rush County.

2.3 Principal Flood Problems

The history of flooding on the streams within Rush County indicates that flooding may occur during any season of the year. The majority of large floods have occurred between late winter and early summer.

The largest recorded flood on the Big Blue River in Rush County at the Carthage gaging station (No. 0336100, 31 years of record), is 12,900 cubic feet per second (cfs) for the 1963 flood (Reference 2). The estimated return period for this flood is 90 years. The largest recorded flood for the Flatrock River at the St. Paul gaging station (No. 03363500, 49 years of record)

located 15 miles downstream of Rush County is 18,500 cfs in 1949. This flood is estimated to have a 25-year return period. Other large floods have occurred on the Flatrock River in 1963 with a discharge of 17,100 cfs and 1968 with a discharge of 17,600 cfs. No flood records are available for the smaller streams studied in detail in this report.

2.4 Flood Protection Measures

An "Upper Big Blue River Flood Control Project" is currently in progress in Rush County and Henry County by the SCS. Thus far, seven structures have been or are very close to being in operation, thus, the effects of these structures were included in this report. Two of the seven structures are located in Rush County: one on Goose Creek 2.27 miles upstream from the mouth with a drainage area of 5.03 square miles, and the other on Three Mile Creek 2,300 feet upstream from the mouth with a drainage area of 11.35 square miles. Two future structures: one controlling 22.35 square miles on Montgomery Creek and 23.14 square miles on Duck Creek in Rush County, and the other controlling 2.38 square miles on Lick Creek and 1.36 square miles on Mooh Brook in Henry County, are planned for operation in four or five years. The effects these structures may have on Big Blue River flood flow have not been included in this study. A multi-purpose flood control project, Big Blue Lake by the COE, is proposed upstream of the study area on the mainstem of the Big Blue River. However, this project is still in the early planning stages. No other flood protection structures exist or are planned for Rush County.

There are no existing county-wide flood plain zoning ordinances, building codes or other regulatory measures. However, Rush County is participating in the National Flood Insurance Program. Interim measures connected with this program call for a review of floodprone development, while full compliance with the program requires the adoption of zoning ordinances which regulate the development in areas of potential flood hazards based on standards established by FEMA.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 per cent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (one per cent chance of annual occurrence) in any 50-year period is about 40 per cent (four in ten), and for any 90-year period, the risk increases to about 60 per cent (six in ten). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

For the Big Blue River, the discharges are based on a statistical analysis of discharge records at the Shelbyville (No. 03361500, 38 years of record) and Carthage gaging stations. This analysis followed the standard log-Pearson Type III method as outlined by the Water Resources Council (Reference 3). Flood discharges for the Flatrock River are based on a region wide comparison both coordinated profiles for similar basins and statistics of 24 area stream gages. An analysis of the mean logarithms and standard deviations of the annual peaks of 24 area stream gages confirmed a strong regional consistency. Six Mile Creek, Three Mile Creek, Goose Creek and Charlottes Brook flood discharges were determined using the TR-20 computer program developed by the SCS (Reference 5). The TR-20 program determines peak flows from rainfall data based on the basin characteristics such as drainage area, stream slope, soil cover, vegetation and land use characteristics. Discharges on Goose Creek decrease downstream of Big Blue Dam No. 21 due to storage in the reservoir.

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each flooding source studied in detail in the community are shown in Table 1.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the streams in the community were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals along each flooding source studied in detail.

Cross sections for the backwater analysis of the streams studied in detail were obtained in 1979 by field survey and from aerial photographs at a negative scale of 1:7920 (Reference 5). All bridges, dams and culverts were field measured to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map.

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and flood plain areas. Values listed in various publications were used as guides in choosing the roughness factors (References 6, 7 and 8). Stream channel roughness values ranged from 0.035 to 0.060 for the Flatrock River and from 0.040 to 0.060 for the Big Blue River. Channel roughness values for the smaller streams studied in detail ranged between 0.035 and 0.070. Flood plain roughness values ranged from 0.025 to 0.095 for the Flatrock River and from 0.040 to 0.120 for the Big Blue River. Smaller streams studied in detail in this report had flood plain roughness values ranging between 0.040 and 0.095.

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TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA SQ MILES	PEAK DISCHARGES (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
FLATROCK RIVER					
County Road 350 South	180	10,750	15,750	17,800	23,000
Conrail	168	10,200	15,000	17,100	22,000
Downstream of Ben Davis Creek	140	9,100	13,400	15,250	19,500
0.2 mile downstream of County Road 300 North	135	8,900	13,000	14,950	19,000
BIG BLUE RIVER					
Upstream of Six Mile Creek	196	8,400	11,800	13,300	15,400
County Road 800 North	188	8,000	11,600	13,100	15,000
Upstream of Three Mile Creek	161	6,900	9,600	11,000	12,500
Upstream of Montgomery Creek	134	5,600	7,700	8,800	10,000
SIX MILE CREEK					
Mouth	45.6	4,200	5,900	6,600	8,600
County Road 800 North	44.0	4,100	5,800	6,500	8,400
0.3 mile downstream of County Road 900 North	41.1	3,950	5,550	6,250	8,100
Upstream of Dilly Brook	32.8	3,500	5,000	5,600	7,200
Upstream of Miles Creek	30.0	3,380	4,750	5,370	6,900
Upstream of Unnamed Tributary north of County Road 1000 North	28.6	3,300	4,600	5,200	6,700
Upstream of Charlottes Brook	24.7	3,050	4,300	4,750	6,200
CHARLOTTES BROOK					
Mouth	3.7	1,170	1,630	1,840	2,320
About 0.8 mile upstream of mouth	2.6	960	1,380	1,550	1,920

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TABLE 1 - SUMMARY OF DISCHARGES (Continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA SQ MILES	PEAK DISCHARGES (CFS) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
GOOSE CREEK					
Mouth	7.2	855	1,230	1,445	1,900
About 1.2 miles upstream of mouth	5.9	130	320	460	860
Upstream of Big Blue Dam No. 2	5.0	1,350	1,900	2,150	2,700
About 0.7 mile upstream of Big Blue Dam No. 2	4.0	1,200	1,700	1,910	2,400
THREE MILE CREEK					
Mouth	13.0	235	250	257	264
Upstream of Big Blue Dam No. 3	11.4	2,050	2,900	3,250	4,200
About 1,800 feet downstream of Campground Dam	10.0	1,920	2,700	3,050	3,900
About 2,000 feet downstream of County Road 310 West	9.0	1,800	2,560	2,900	3,700
County Road 450 West	8.0	1,700	2,400	2,700	3,500
County Road 250 West	6.6	1,550	2,200	2,480	3,180

Starting water-surface elevations for the step-backwater analysis of the Flatrock River, Goose Creek and Three Mile Creek were derived using the slope-area method. The Big Blue River and Six Mile Creek starting water-surface elevations were obtained from the concurrent downstream study for the County of Hancock (Reference 9). Starting elevations for Charlottes Brook were taken from Six Mile Creek assuming coincident flood peaks. Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 computer program (Reference 10).

High water marks of historic floods were used where available to calibrate the hydraulic computer models. Elevations of the 1959 flood on the Flatrock River, approximately a 10-year event, and the 1963 flood on the Big Blue River, approximately a 100-year event, were used for calibration. No high water records were available for other watercourses studied in detail in this report.

The effects of ice jams on flood elevations are not included in the analyses.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals.

The hydraulic analyses for this study are based only on the effects of unobstructed flow. The flood elevations as shown on the profiles are, therefore, considered valid only if hydraulic structures, in general, remain unobstructed and if channel and overbank conditions remain essentially the same as ascertained during this study.

All elevations are referenced from National Geodetic Vertical Datum of 1929 (NGVD); elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100-year and the 500-year floods have been delineated using the elevations determined at each cross section; between cross sections the boundaries were interpolated using topographic maps at a scale of 1:4800 with a contour interval of two feet (Reference 11). For the streams studied by approximate methods, the boundary was taken directly from the Flood Hazard Boundary Map (Reference 12).

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map. Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to lack of detailed topographical information or to limitations of the map scale, such areas are not shown. In cases where the 100-year and the 500-year flood boundaries are close together, nly the 100-year boundary has been shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The State of Indiana, however, as set down by the Indiana Flood Control Act of 1945 and the Natural Resources Commission Policy Guidelines, Section 6, adopted March 28, 1974 (Reference 13), has designated that encroachment in the flood plain is limited to that which will cause no significant increase in flood height. As a result, no more than 0.1-foot surcharge has been delineated for this study. The floodways shown in the report were approved by the Indiana State Natural Resources Commission when the review process was completed.

The floodways for this study were computed as all areas of effective flow conveyance. A second step, however, involved the delineation of "Administrative Floodways" as established under IDNR criteria. Briefly, the Water Resources Commission, acting through the IDNR, stipulates that any levee, bridge, road or railroad track embankment or structure that significantly penetrates into the 100-year flood boundary is to be included in the floodway. This allows the Commission to maintain control and authority over land areas that would normally fall within the floodway if they had not been built. Also, the maintenance of these types of structures is facilitated by keeping them under Commission jurisdiction.

The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

As shown on the Flood Boundary and Floodway Map, the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE
BIG BLUE RIVER							
A	45.70	1030	2154	6.2	851.1	851.1	0.0
B	45.84	1138	7009	1.9	852.4	852.4	0.0
C	46.00	1246	9895	1.3	852.6	852.6	0.0
D	46.15	1283	7580	1.8	852.8	852.8	0.0
E	46.30	1460	7356	1.8	853.1	853.1	0.0
F	46.57	1476	7003	1.9	853.5	853.5	0.0
G	46.81	1220	4456	3.0	854.1	854.1	0.0
H	46.90	1432	6841	1.9	854.7	854.7	0.0
I	47.16	1190	5004	2.7	855.2	855.2	0.0
J	47.28	1427	7249	1.8	856.1	856.1	0.0
K	47.49	1649	10,928	1.2	856.6	856.6	0.0
L	47.60	1770	8370	1.6	857.0	857.0	0.0
M	47.81	1369	11,100	1.2	857.6	857.6	0.0
N	47.92	1665	6584	2.0	857.9	857.9	0.0
O	48.20	1279	7072	1.9	859.9	859.9	0.0
P	48.40	1084	5592	2.4	860.5	860.5	0.0
Q	48.57	1261	6178	2.2	861.2	861.2	0.0
R	48.66	1150	5867	2.3	861.5	861.5	0.0
S	49.04	1154	4815	2.8	862.4	862.4	0.0
T	49.13	1213	5118	2.6	863.2	863.2	0.0
U	49.37	1490	5337	2.5	864.0	864.0	0.0
V	49.39	1121	5197	2.5	864.2	864.2	0.0
W	49.45	1200	4596	2.9	864.6	864.6	0.0
X	49.64	1175/900[2]	2065	6.3	866.8	866.8	0.0
Y	49.75	1145/900[2]	2422	5.4	869.5	869.5	0.0
Z	49.90	1190	3065	4.3	870.8	870.8	0.0

[1]MILES ABOVE MOUTH
[2]TOTAL WIDTH / WIDTH WITHIN UNINCORPORATED AREA

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

FLOODWAY DATA

BIG BLUE RIVER

BEST DOCUMENT AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE
BIG BLUE RIVER							
AA	50.10	1210/1050[2]	4117	3.2	872.6	872.6	0.0
AB	50.26	1275/1100[2]	10,856	1.2	873.0	873.0	0.0
AC	50.53	1100	2821	4.6	873.0	873.0	0.0
AD	50.61	1165/1100[2]	2984	4.4	873.8	873.8	0.0
AE	50.70	1252/1100[2]	3257	4.0	874.1	874.1	0.0
AF	50.95	1218/1150[2]	10,053	1.3	874.9	874.9	0.0
AG	51.23	1895	2917	4.5	875.6	875.6	0.0
AH	51.38	1435	6375	2.1	876.1	876.1	0.0
AI	51.70	1166	7174	1.8	876.6	876.6	0.0
AJ	52.00	1129	6578	2.0	877.1	877.1	0.0
AK	52.23	1182	5939	2.2	877.8	877.8	0.0
AL	52.50	1180	4852	2.7	878.9	878.9	0.0
AM	52.71	1093	2960	4.4	880.3	880.3	0.0
AN	53.08	1563	7312	1.5	883.5	883.5	0.0
AO	53.26	1212	3989	2.8	884.5	884.5	0.0
AP	53.48	1207	4020	2.7	885.4	885.4	0.0
AQ	53.66	1204	6375	1.7	886.3	886.3	0.0
AR	53.93	1248	3714	3.0	886.9	886.9	0.0
AS	54.22	1367	3445	3.2	889.3	889.3	0.0
AT	54.64	1586	8589	1.3	890.4	890.4	0.0
AU	54.86	1840	9102	1.2	890.6	890.6	0.0
AV	55.15	1420	7035	1.3	891.0	891.0	0.0
AW	55.34	1410/650[2]	4810	1.8	891.6	891.6	0.0
AX	55.43	1185/200[2]	4856	1.8	891.8	891.8	0.0

[1]MILES ABOVE MOUTH
[2]TOTAL WIDTH / WIDTH WITHIN UNINCORPORATED AREA

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

FLOODWAY DATA

BIG BLUE RIVER

BEST DOCUMENT AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE
FLATROCK RIVER							
A	53.18	1483	6307	2.8	936.9	936.9	0.0
B	53.42	1721	7805	2.3	937.8	937.8	0.0
C	54.19	2100	11,522	1.5	939.6	939.6	0.0
D	55.14	1900	8088	2.2	941.4	941.4	0.0
E	55.63	1849	8830	2.0	942.9	942.9	0.0
F	55.99	1968	9870	1.8	944.0	944.0	0.0
G	56.73	1972	9974	1.8	945.7	945.7	0.0
H	57.29	2242	10,327	1.7	946.7	946.7	0.0
I	57.68	1695	8585	2.1	947.6	947.6	0.0
J	58.11	262	2150	8.0	950.1	950.1	0.0
K	58.45	1017	6553	2.6	952.5	952.5	0.0
L	58.59	1421	11,109	1.5	953.1	953.1	0.0
M	58.70	450/100[2]	4150	4.1	955.1	955.1	0.0
N	58.99	1160/1000[2]	7633	2.2	955.5	955.5	0.0
O	59.09	1570	10,562	1.6	955.7	955.7	0.0
P	59.32	1822	13,137	1.3	955.8	955.8	0.0
Q	59.43	2780	4519	3.8	956.2	956.2	0.0
R	59.52	2150	10,982	1.6	956.4	956.4	0.0
S	59.70	2747	4660	3.7	957.4	957.4	0.0
T	59.85	2338	14,483	1.2	957.5	957.5	0.0
U	60.44	2357	10,038	1.7	958.0	958.0	0.0
V	60.78	2530	10,649	1.6	958.9	958.9	0.0
W	61.38	2727	10,027	1.7	960.5	960.5	0.0
X	61.82	1660	4263	4.0	962.6	962.6	0.0
Y	61.91	1115	6875	2.2	963.0	963.0	0.0
Z	61.99	813	3496	4.4	963.1	963.1	0.0

[1]MILES ABOVE MOUTH
[2]TOTAL WIDTH / WIDTH WITHIN UNINCORPORATED AREA

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

FLOODWAY DATA

FLATROCK RIVER

BEST DOCUMENT AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE
FLATROCK RIVER							
AA	62.34	754	4284	3.6	964.9	964.9	0.0
AB	62.57	1163	3755	4.1	965.5	965.5	0.0
AC	62.99	1640	9276	1.6	966.1	966.1	0.0
AD	63.50	1620	8605	1.7	966.7	966.7	0.0
AE	63.71	1552	5079	2.9	967.4	967.4	0.0
SIX MILE CREEK							
A	8896[2]	98	812	8.1	859.3	859.3	0.0
B	9996[2]	487	2852	2.3	861.1	861.1	0.0
C	12,196[2]	940	3379	2.0	863.2	863.2	0.0
D	12,802[2]	752	2062	3.2	863.9	863.9	0.0
E	14,032[2]	672	2512	2.6	866.2	866.2	0.0
F	23,533[2]	171	1200	4.7	883.4	883.4	0.0
G	25,563[2]	739	3154	1.8	884.7	884.7	0.0
H	27,363[2]	767	2619	2.1	885.8	885.8	0.0
I	28,393[2]	640	1176	4.9	887.8	887.8	0.0
J	28,618[2]	809	2267	2.5	888.9	888.9	0.0
K	31,068[2]	980	1945	2.8	892.9	892.9	0.0
L	32,348[2]	572	1494	3.6	896.0	896.0	0.0
M	33,207[2]	663	1711	3.1	898.6	898.6	0.0
N	36,367[2]	920	1874	2.9	904.1	904.1	0.0
O	38,447[2]	652	1368	3.8	908.6	908.6	0.0
P	41,047[2]	529	1426	3.6	913.8	913.8	0.0
Q	41,396[2]	900[3]	2042	2.3	915.5	915.5	0.0
R	42,666[2]	403	933	5.1	916.9	916.9	0.0
S	45,246[2]	714	2372	2.0	922.1	922.1	0.0
T	47,316[2]	500	1703	2.8	926.2	926.2	0.0
U	48,296[2]	520	1718	2.8	927.2	927.2	0.0

[1]MILES ABOVE MOUTH
[2]FEET ABOVE MOUTH
[3]COMBINED FLOODWAY WIDTH OF SIX MILE CREEK AND CHARLOTTES BROOK

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

FLOODWAY DATA

FLATROCK RIVER - SIX MILE CREEK

BEST DOCUMENT AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE
GOOSE CREEK							
A	0.71	600	348	4.2	878.6	878.6	0.0
B	1.00	380	659	2.2	883.7	883.7	0.0
C	1.20	328	584	2.5	888.3	888.3	0.0
D	1.40	290	338	1.4	890.4	890.4	0.0
E	1.60	210	269	1.7	895.4	895.4	0.0
F	1.81	54	146	3.2	899.1	899.1	0.0
G	1.90	70	191	2.4	900.9	900.9	0.0
H	2.11	28	90	5.1	904.4	904.4	0.0
I	2.18	138	176	2.6	905.7	905.7	0.0
THREE MILE CREEK							
A	12,672[2]	313	1003	3.0	930.0	930.0	0.0
B	14,098[2]	55	396	7.7	937.4	937.4	0.0
C	14,309[2]	238	869	3.5	938.3	938.3	0.0
D	15,946[2]	306	794	3.8	943.3	943.3	0.0
E	18,058[2]	326	1104	2.6	949.2	949.2	0.0
F	18,744[2]	375	1108	2.6	950.8	950.8	0.0
G	20,011[2]	300	284	10.2	957.2	957.2	0.0
H	22,440[2]	362	1190	2.4	963.6	963.6	0.0
I	23,549[2]	300	325	8.9	968.5	968.5	0.0
J	25,238[2]	525	1752	1.7	972.1	972.1	0.0
K	25,555[2]	466	1358	2.1	973.4	973.4	0.0
L	28,565[2]	326	933	2.9	978.3	978.3	0.0
M	29,410[2]	317	1116	2.4	981.1	981.1	0.0
N	30,043[2]	265	1183	2.1	985.1	985.1	0.0
O	31,258[2]	477	1285	1.9	986.0	986.0	0.0
P	32,947[2]	467	875	2.8	988.3	988.3	0.0

[1]MILES ABOVE CONFLUENCE WITH BIG BLUE RIVER
[2]FEET ABOVE MOUTH

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

FLOODWAY DATA

GOOSE CREEK - THREE MILE CREEK

BEST DOCUMENT AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET/SEC.)	WITH FLOODWAY (NGVD)	WITHOUT FLOODWAY (NGVD)	DIFFERENCE
CHARLOTTES BROOK							
A	367	900[2]	2042	2.3	915.9	915.9	0.0
B	1587	406	986	1.9	919.0	919.0	0.0
C	2457	216	1002	1.8	919.3	919.3	0.0
D	3357	67	233	7.9	921.4	921.4	0.0
E	4177	266	537	2.9	929.9	929.9	0.0
F	5492	201	407	3.8	935.4	935.4	0.0
G	7612	237	528	2.9	942.6	942.6	0.0
H	8427	224	442	3.5	945.8	945.8	0.0
I	9807	220	425	3.6	950.6	950.6	0.0

[1]FEET ABOVE CONFLUENCE WITH SIX MILE CREEK
[2]COMBINED FLOODWAY WIDTH OF SIX MILE CREEK AND CHARLOTTES BROOK

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

FLOODWAY DATA

CHARLOTTES BROOK

BEST DOCUMENT AVAILABLE

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 0.1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

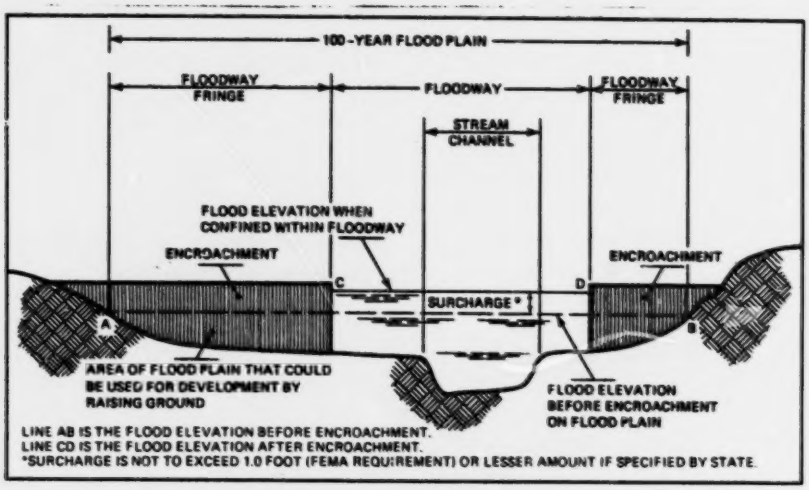
100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FIGURE 2 - Floodway Schematic

The floodways in this report are recommended to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF), and flood insurance zone designations for each flooding source affecting Rush County.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 per cent of the reach.

Average Difference Between 10- and 100-year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for Rush County are shown on the Flood Profiles and are summarized in Table 3, "Flood Insurance Zone Data."

5.2 Flood Hazard Factors

The FHF is used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire unincorporated areas of Rush County were divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations are shown or FHFs determined.
Zones A1-A4, A7:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations are shown, and zones subdivided according to FHF.
Zone B:	Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; or areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community.

BEST DOCUMENT AVAILABLE

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
BIG BLUE RIVER							
REACH 1	0025	–1.6	–0.5	0.6	015	A3	VARIES–SEE MAP
FLATROCK RIVER							
REACH 1	0075,0100	–1.7	–0.5	1.1	015	A3	VARIES–SEE MAP
REACH 2	0100	–2.2	–0.5	1.2	020	A4	VARIES–SEE MAP
REACH 3	0100	–1.4	–0.4	0.8	015	A3	VARIES–SEE MAP
SIX MILE CREEK							
REACH 1	0025	–1.0	–0.3	0.7	010	A2	VARIES–SEE MAP
GOOSE CREEK							
REACH 1	0025	–0.7	–0.2	0.4	005	A1	VARIES–SEE MAP
REACH 2	0025	–1.6	–1.0	1.3	015	A3	VARIES–SEE MAP
REACH 3	0025	–3.5	–1.2	6.3	035	A7	VARIES–SEE MAP

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

BIG BLUE RIVER - FLATROCK RIVER - SIX MILE CREEK - GOOSE CREEK

BEST DOCUMENT AVAILABLE

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
THREE MILE CREEK							
REACH 1	0025	–1.1	–0.4	0.6	010	A2	VARIES–SEE MAP
CHARLOTTES BROOK							
REACH 1	0025	–1.0	–0.3	0.7	010	A2	VARIES–SEE MAP

[1]FLOOD INSURANCE RATE MAP PANEL
[2]WEIGHTED AVERAGE
[3]ROUNDED TO NEAREST FOOT

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

THREE MILE CREEK - CHARLOTTES BROOK

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Rush County is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by FEMA.

6.0 OTHER STUDIES

Flood Insurance Studies are currently being conducted for the City of Rushville (Reference 14) in Rush County and for Shelby and Hancock Counties (References 15 and 9) which border Rush County. The results of these studies match exactly the Rush County Study. No other studies were found to exist at the time of this report.

A Flood Hazard Boundary Map has been published for the community (Reference 12). The differences between the Flood Hazard Boundary Map and this study are justified due to the more detailed nature of this Flood Insurance Study.

This report either supersedes or is compatible with all previous studies published on streams studied in this report and should be considered authoritative for the purposes of the National Flood Insurance Program.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 300 South Wacker Drive, (24th Floor), Chicago, Illinois 60606.

8.0 REFERENCES AND BIBLIOGRAPHY

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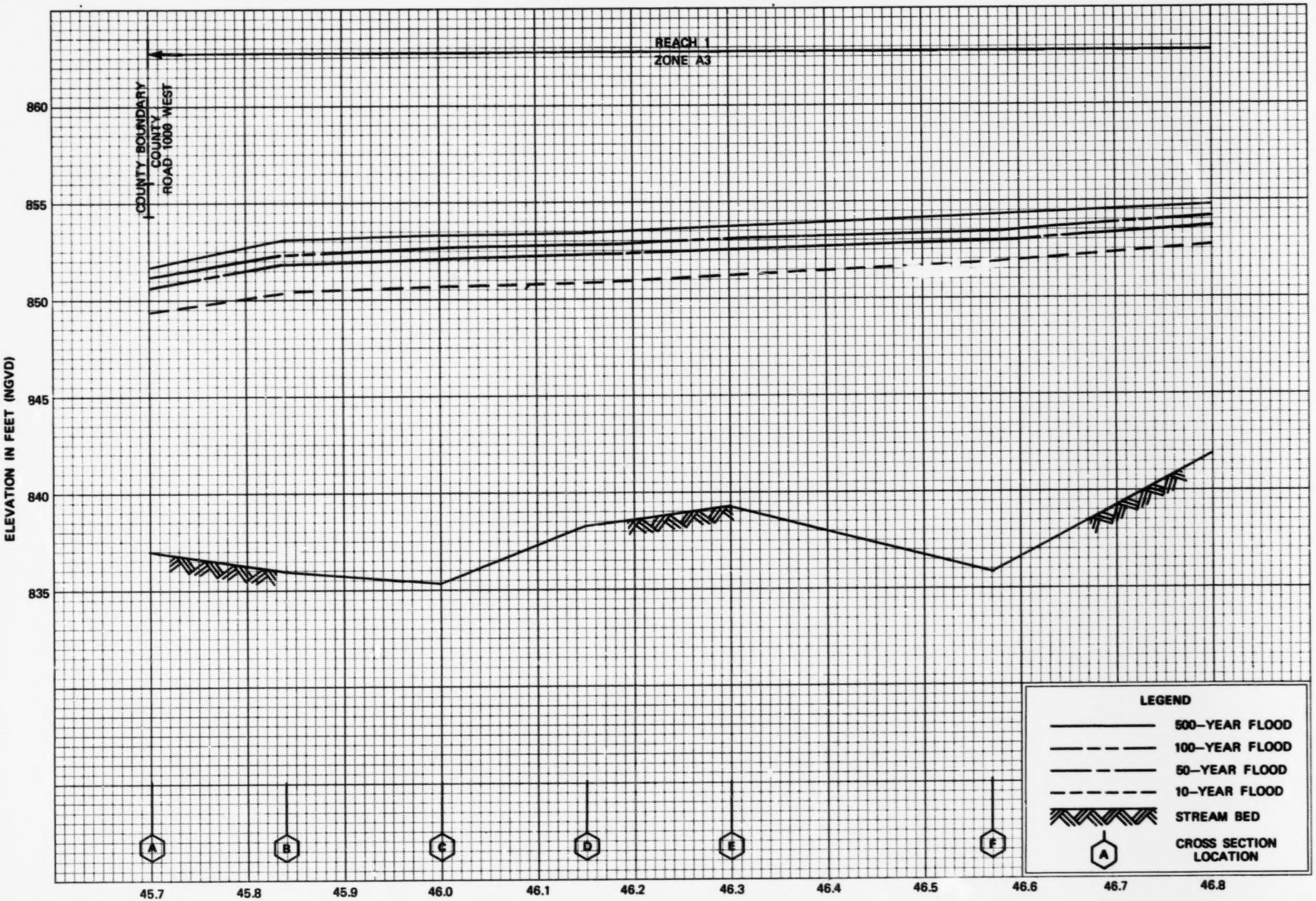


FLOOD PROFILES

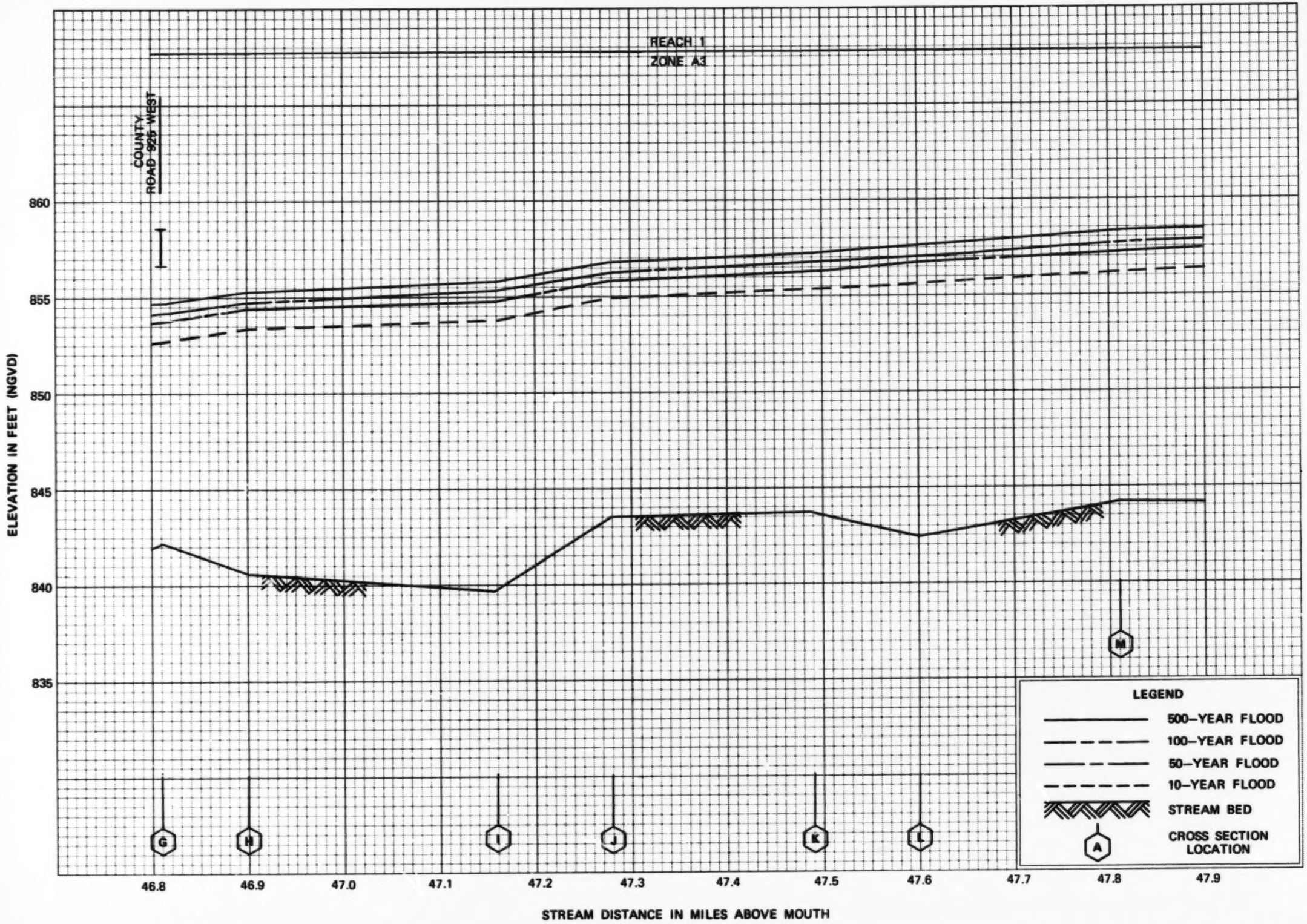
BIG BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

01P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

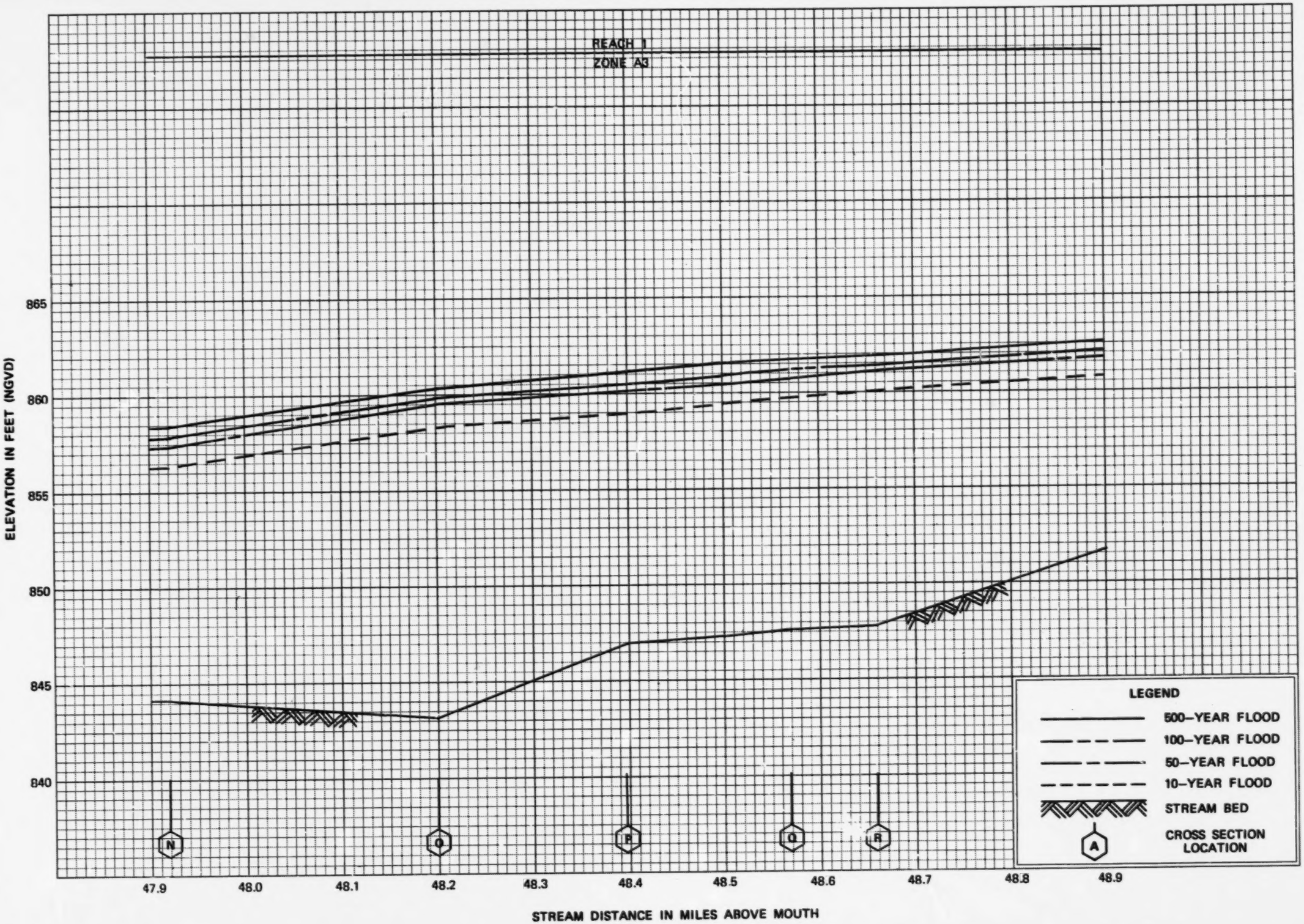
BIG BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

02P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

BIG BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

03P

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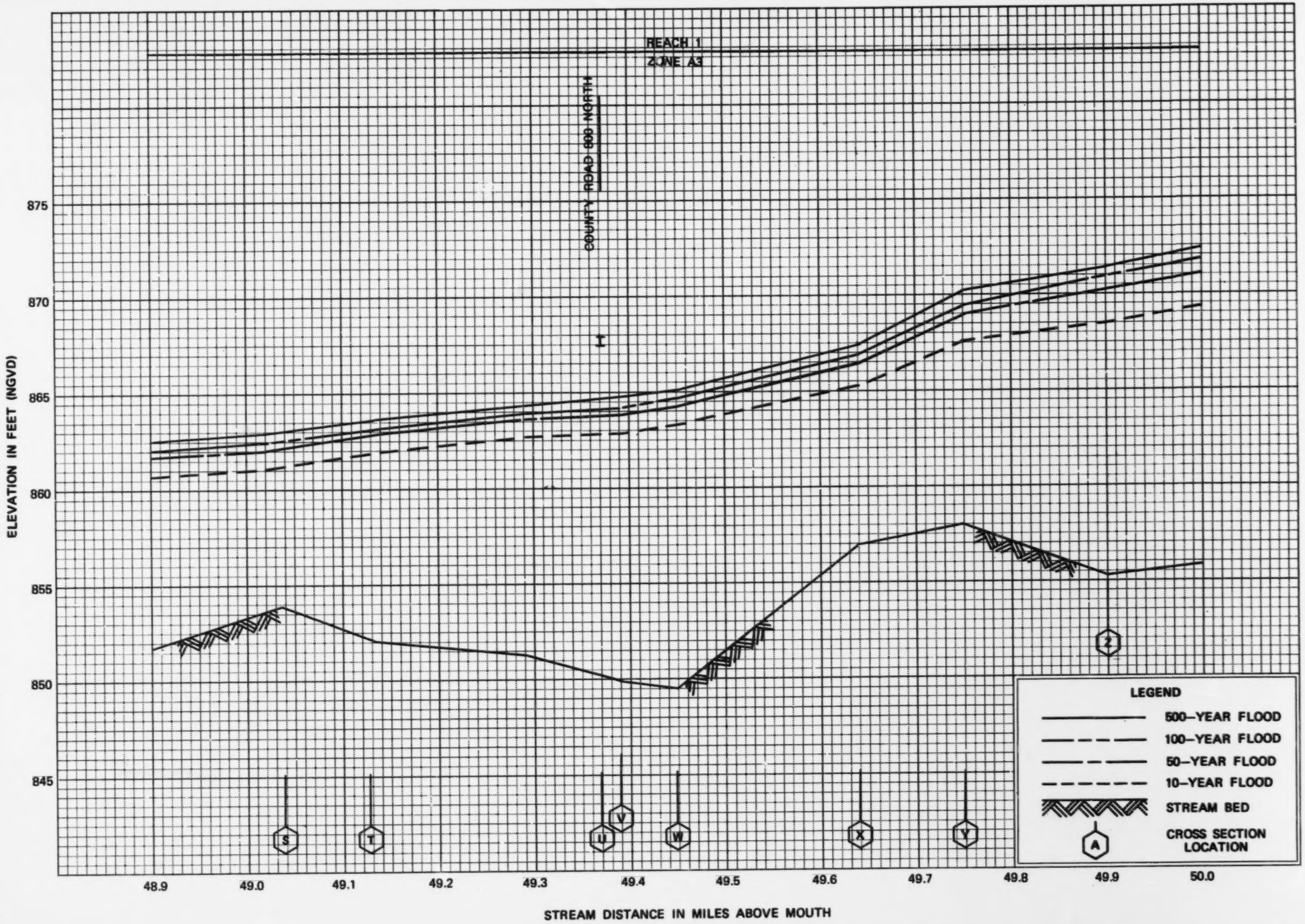


FLOOD PROFILES

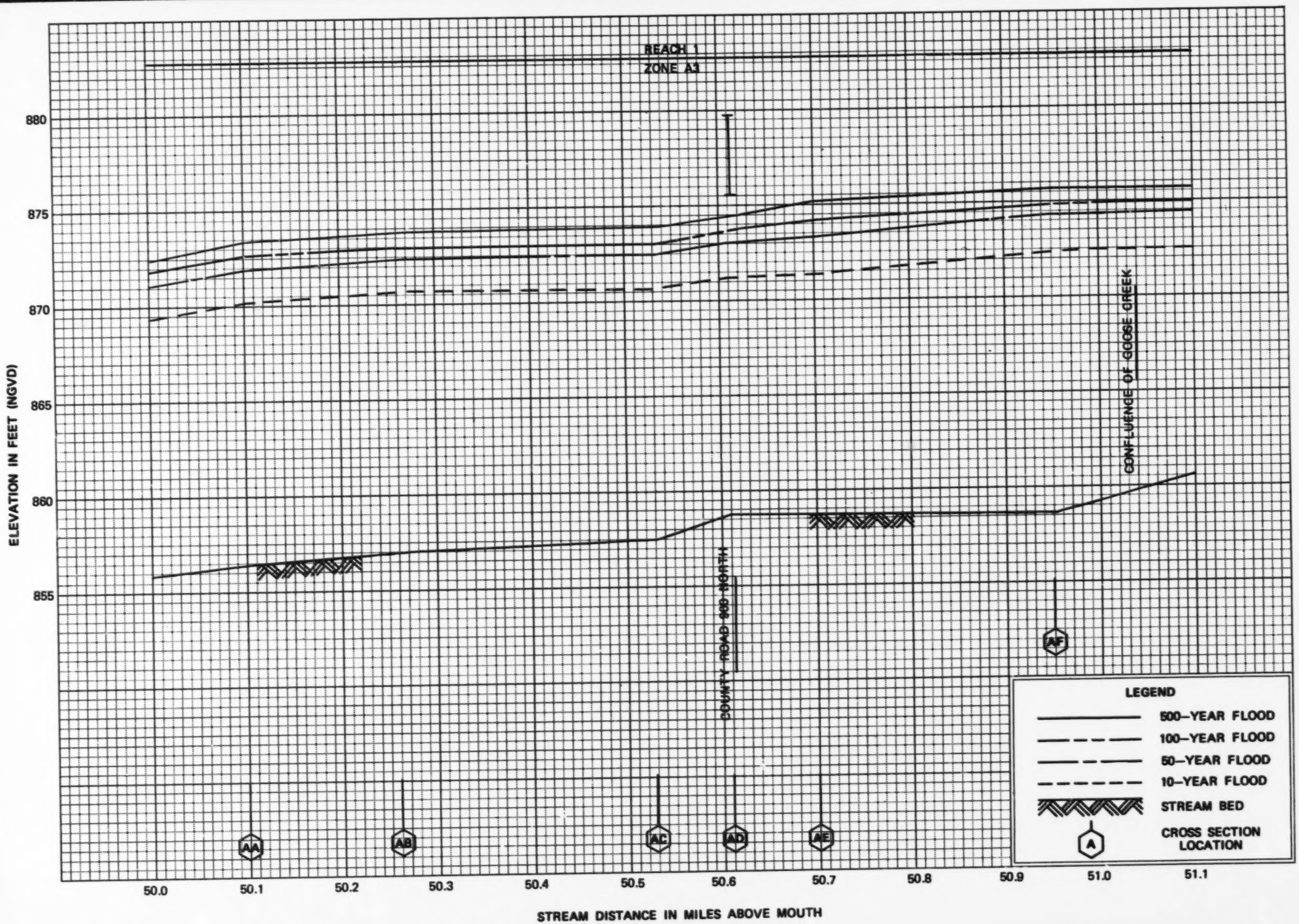
BIG BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

04P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

BIG BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

05P

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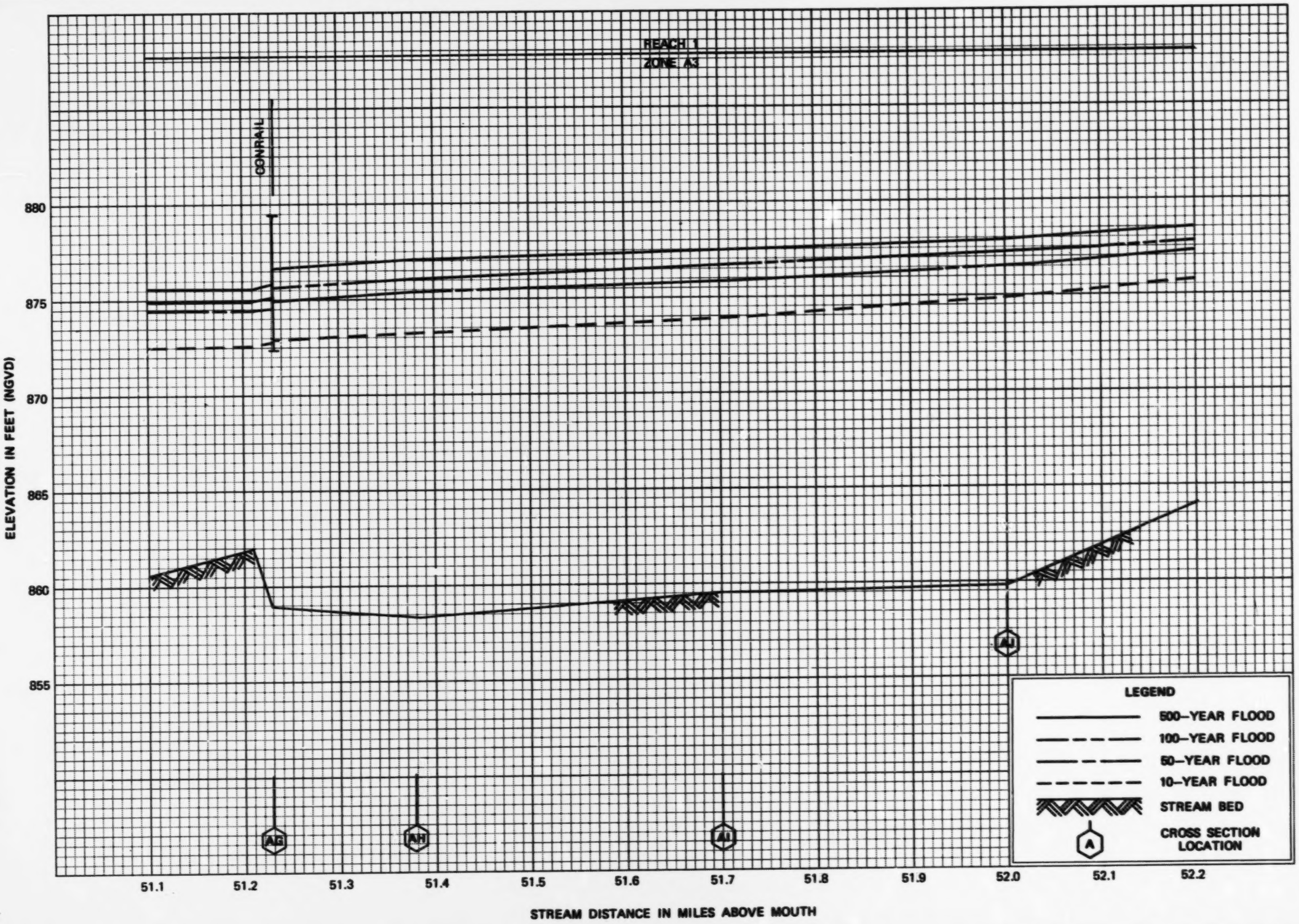

FLOOD PROFILES

BIG BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

06P

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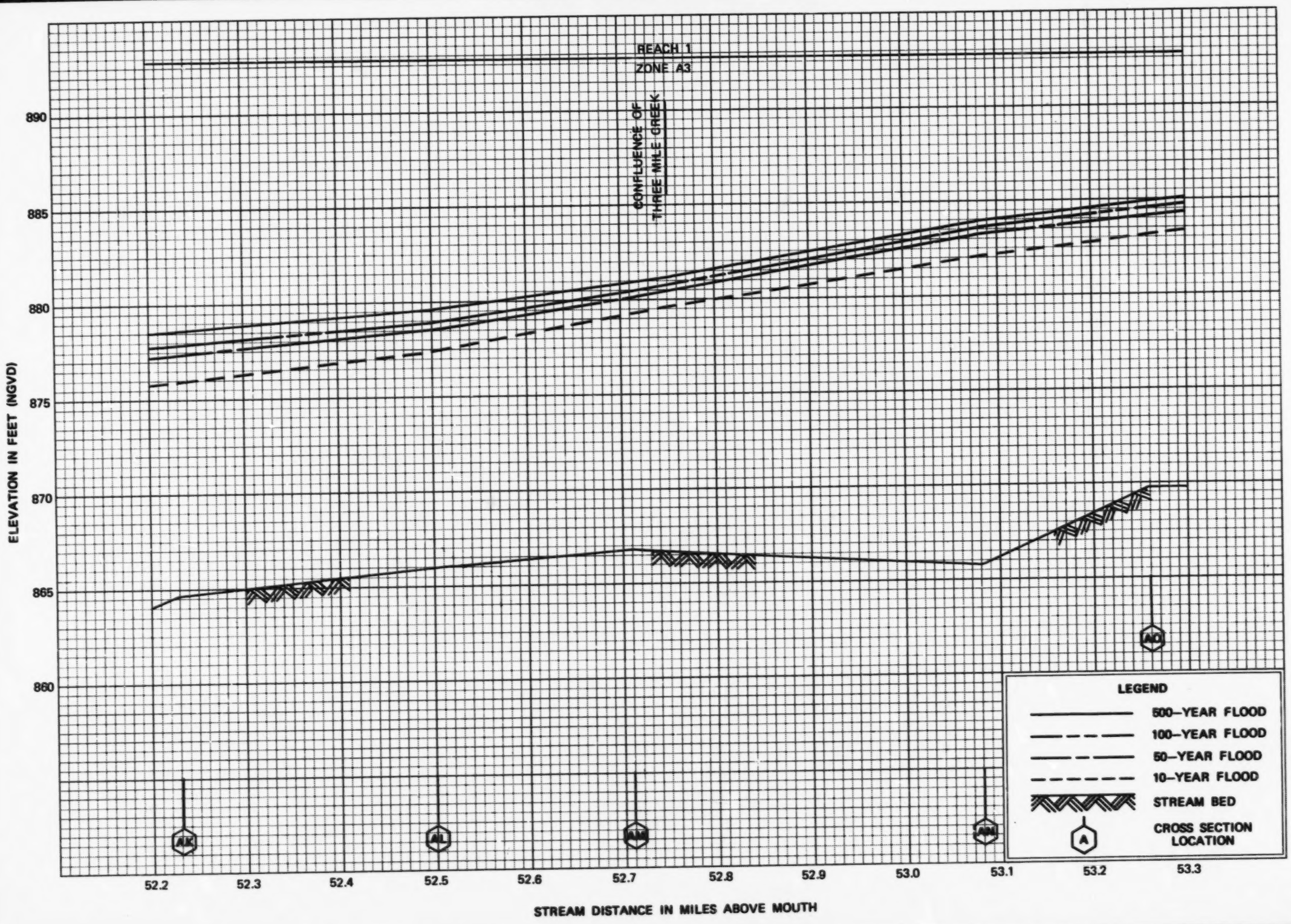


FLOOD PROFILES

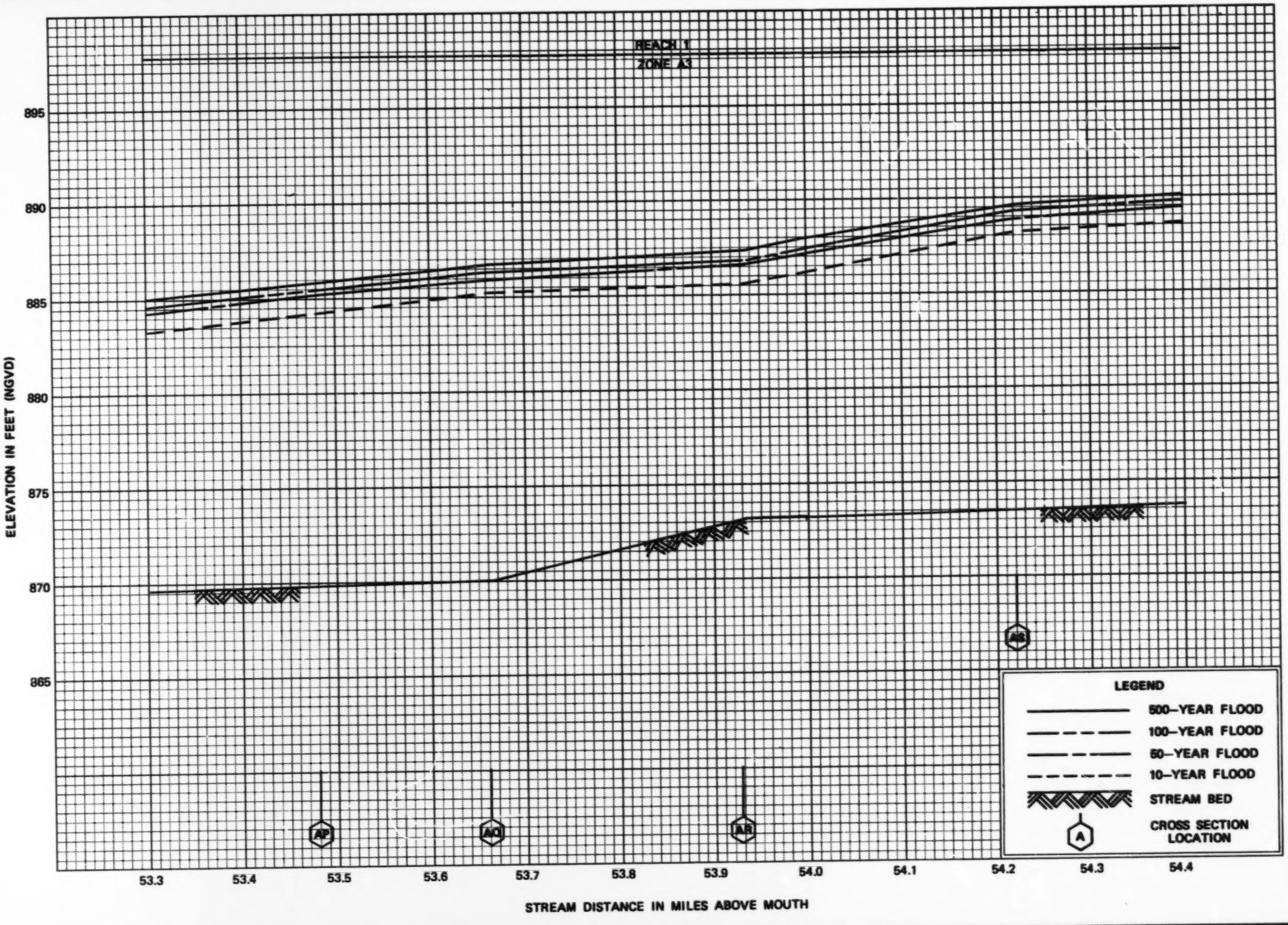
BIG BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

07P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

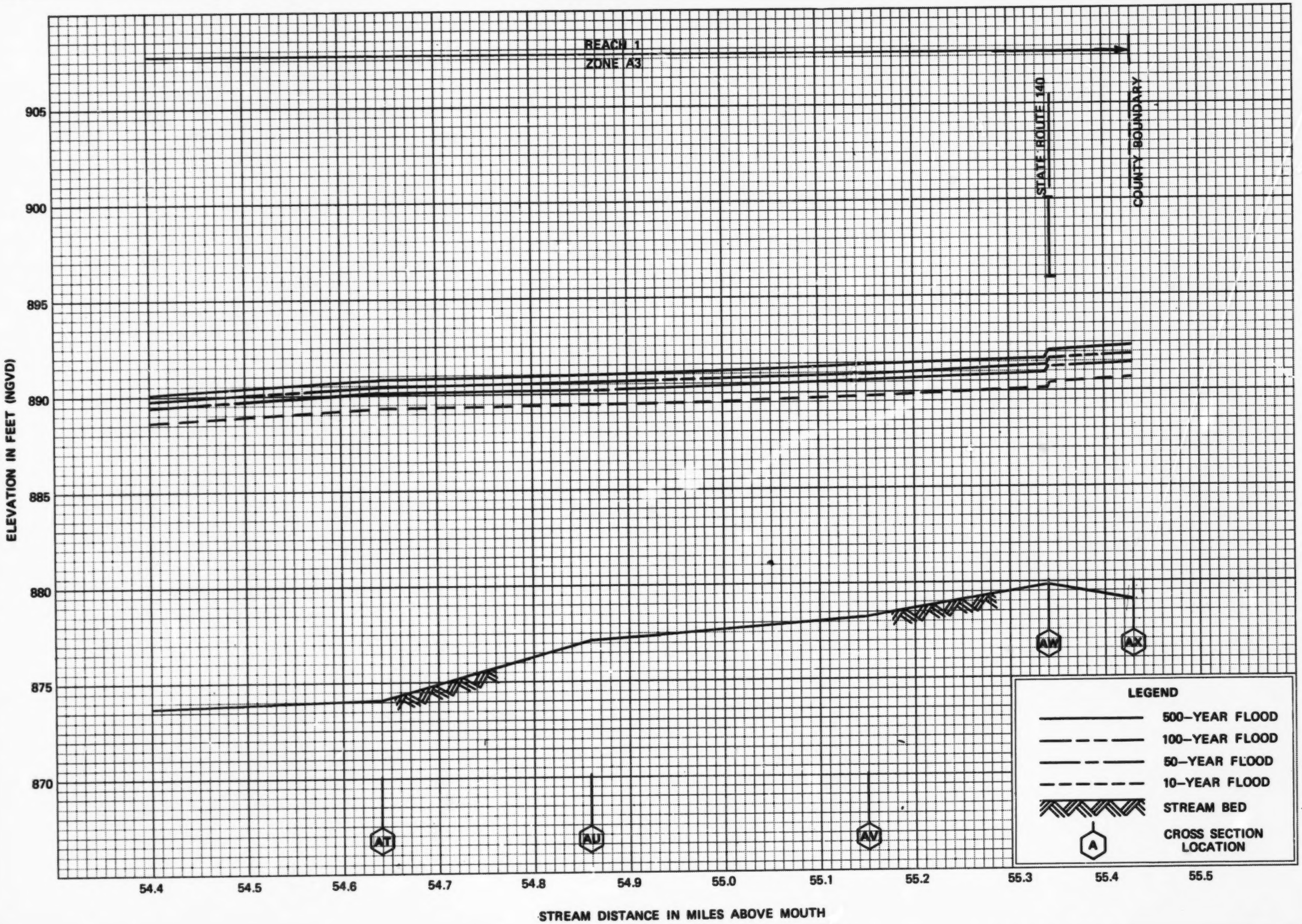
BIG BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN.
(UNINCORPORATED AREAS)

08P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

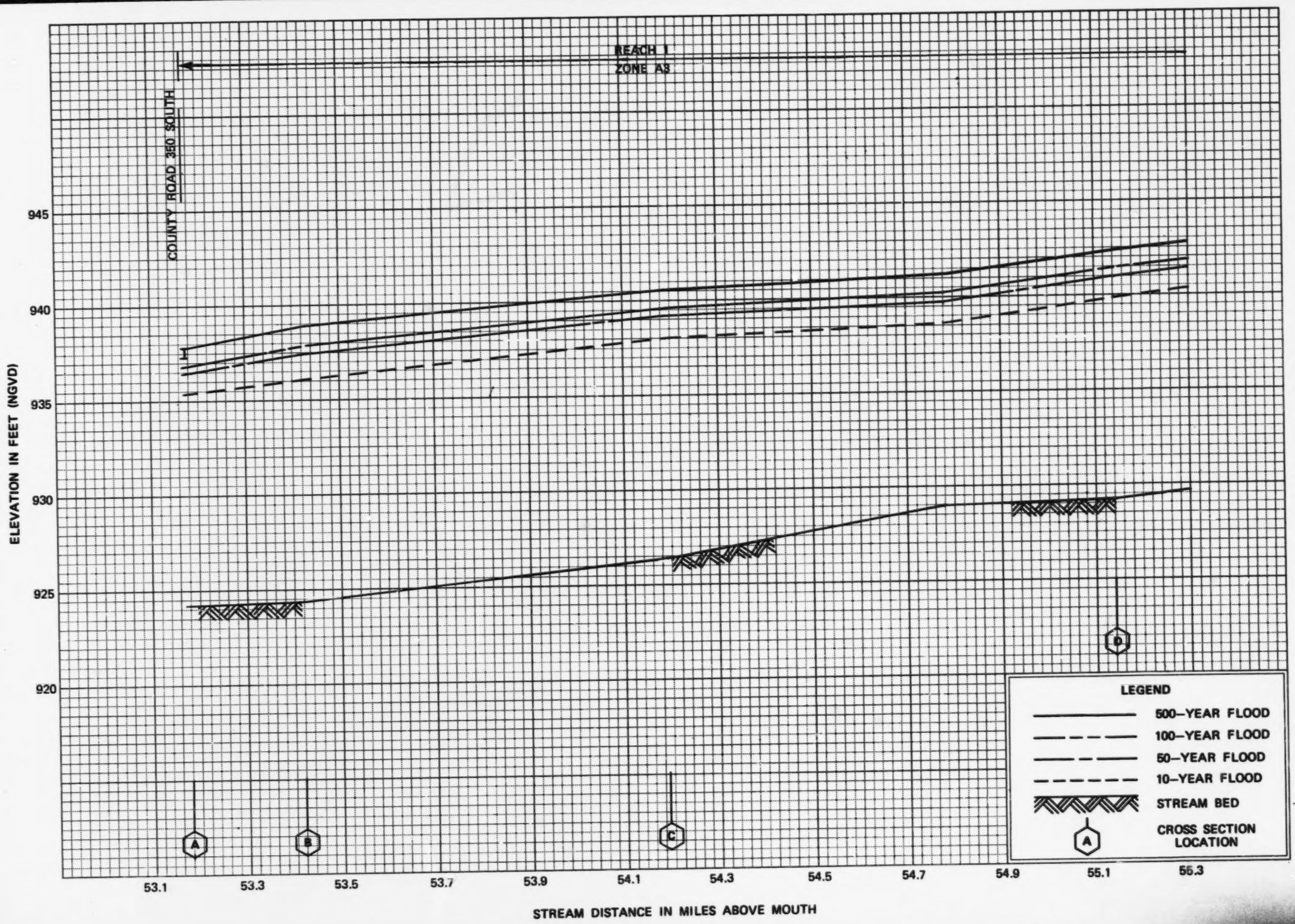
BIG BLUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

09P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

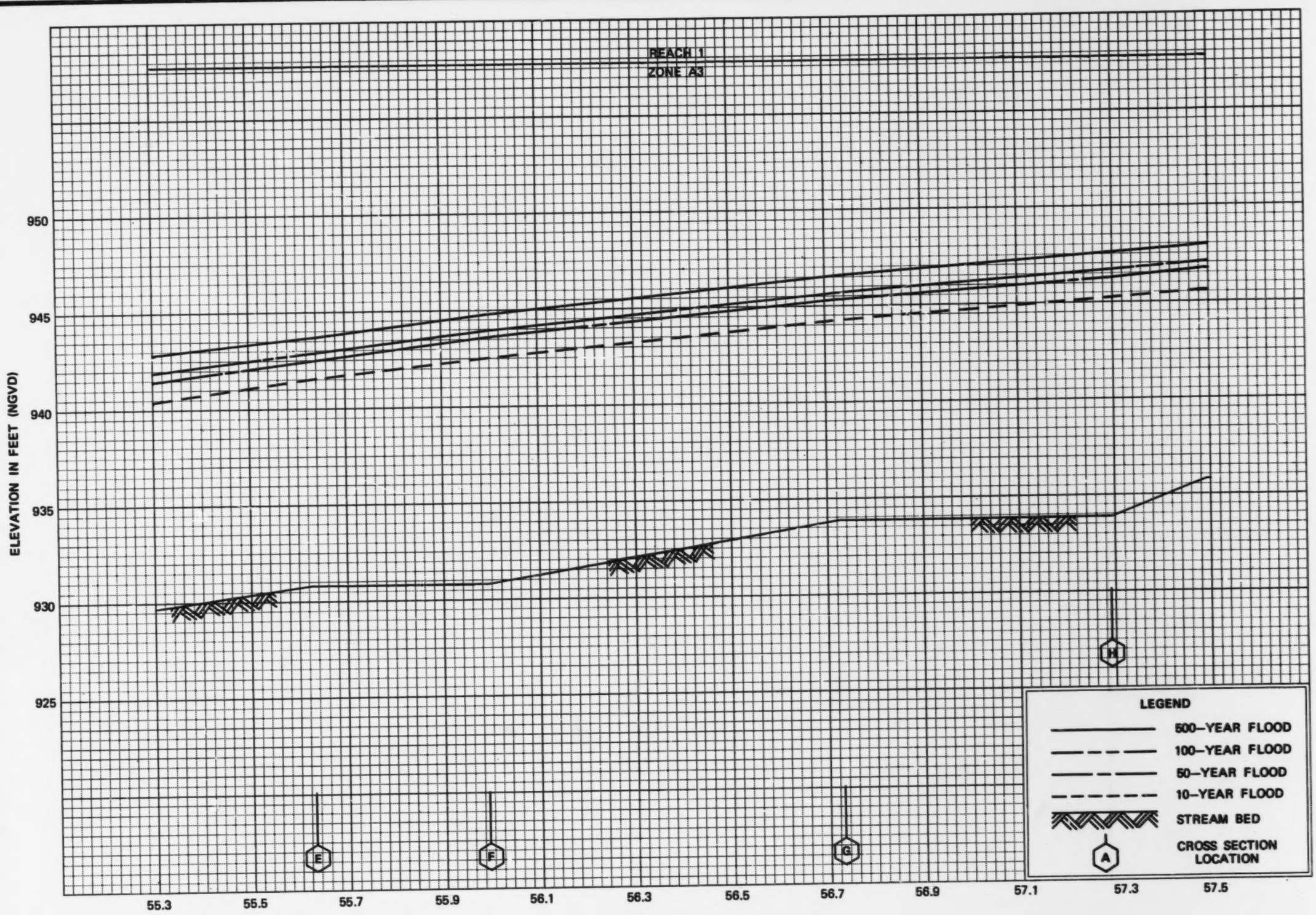
FLATROCK RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

10P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

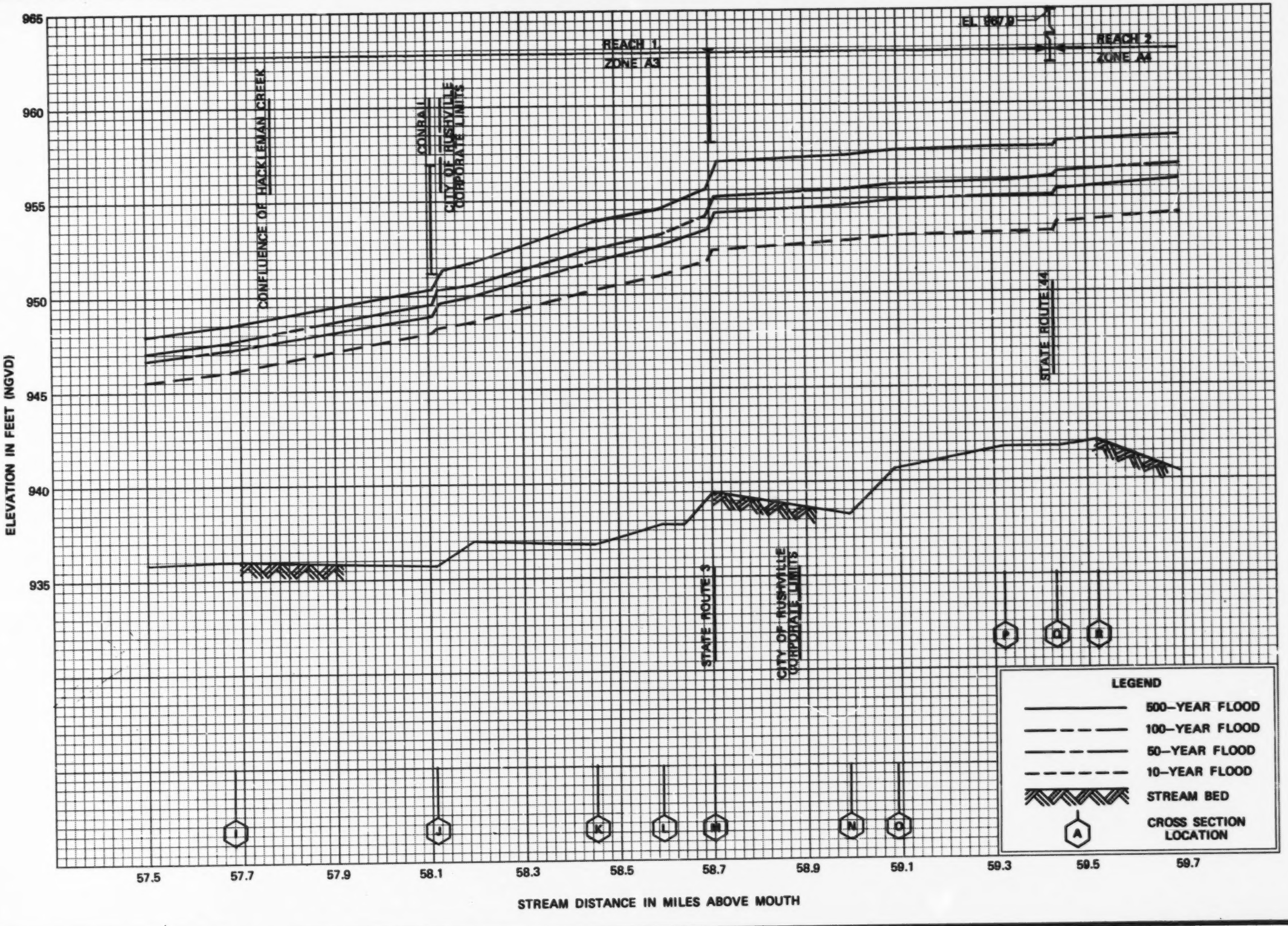
FLATROCK RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

11P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

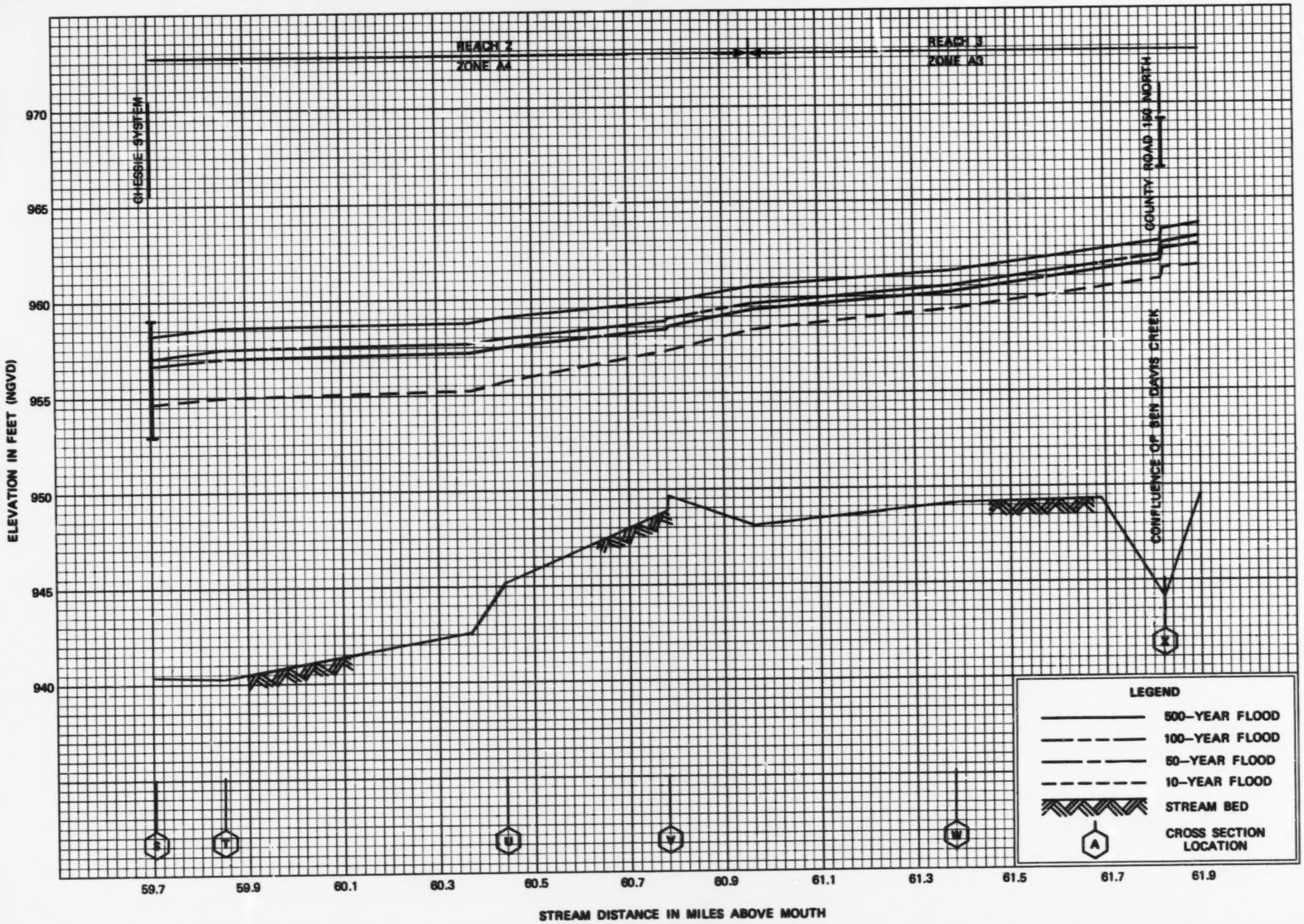
FLATROCK RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
[UNINCORPORATED AREAS]

12P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

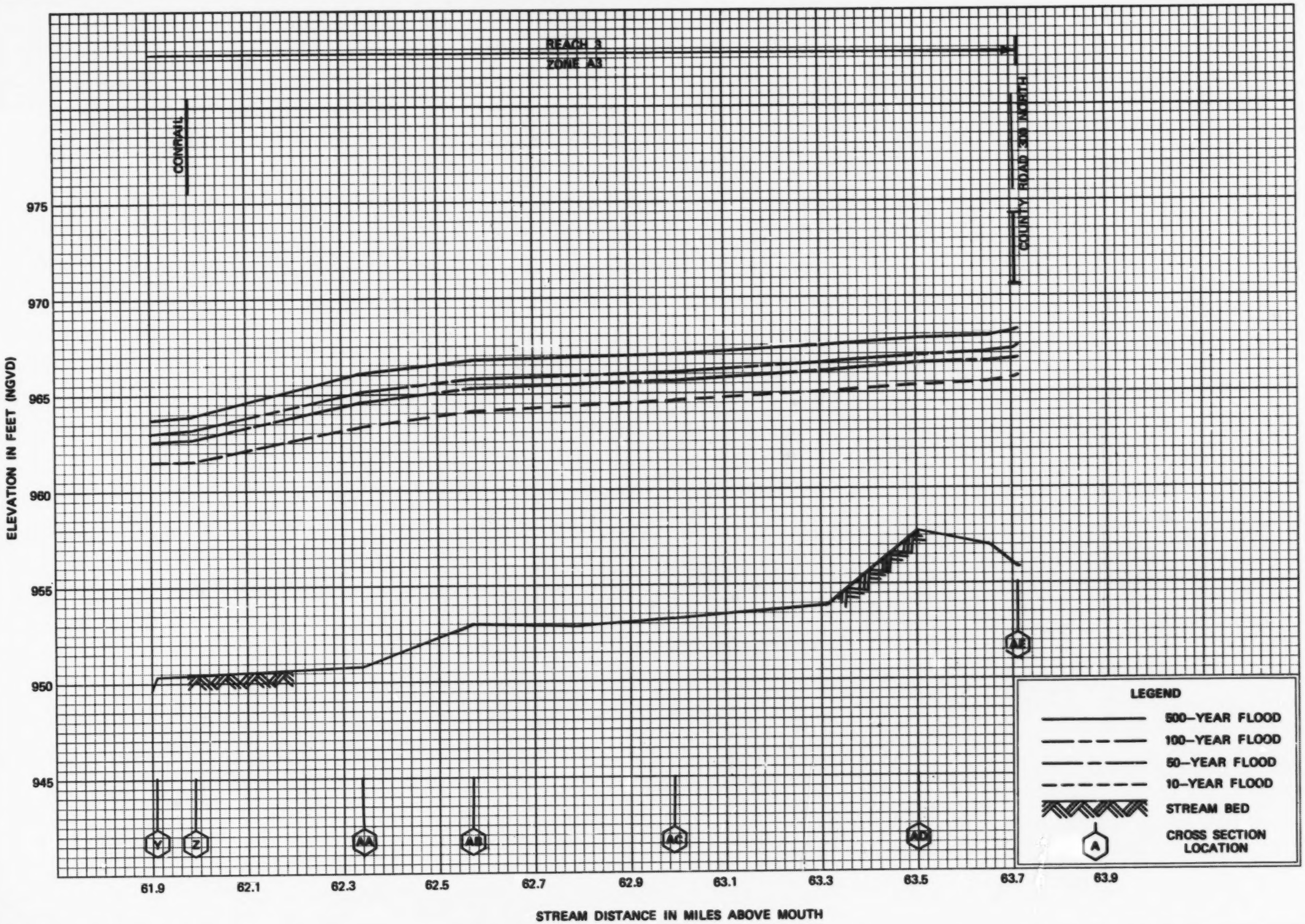
FLATROCK RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

13P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

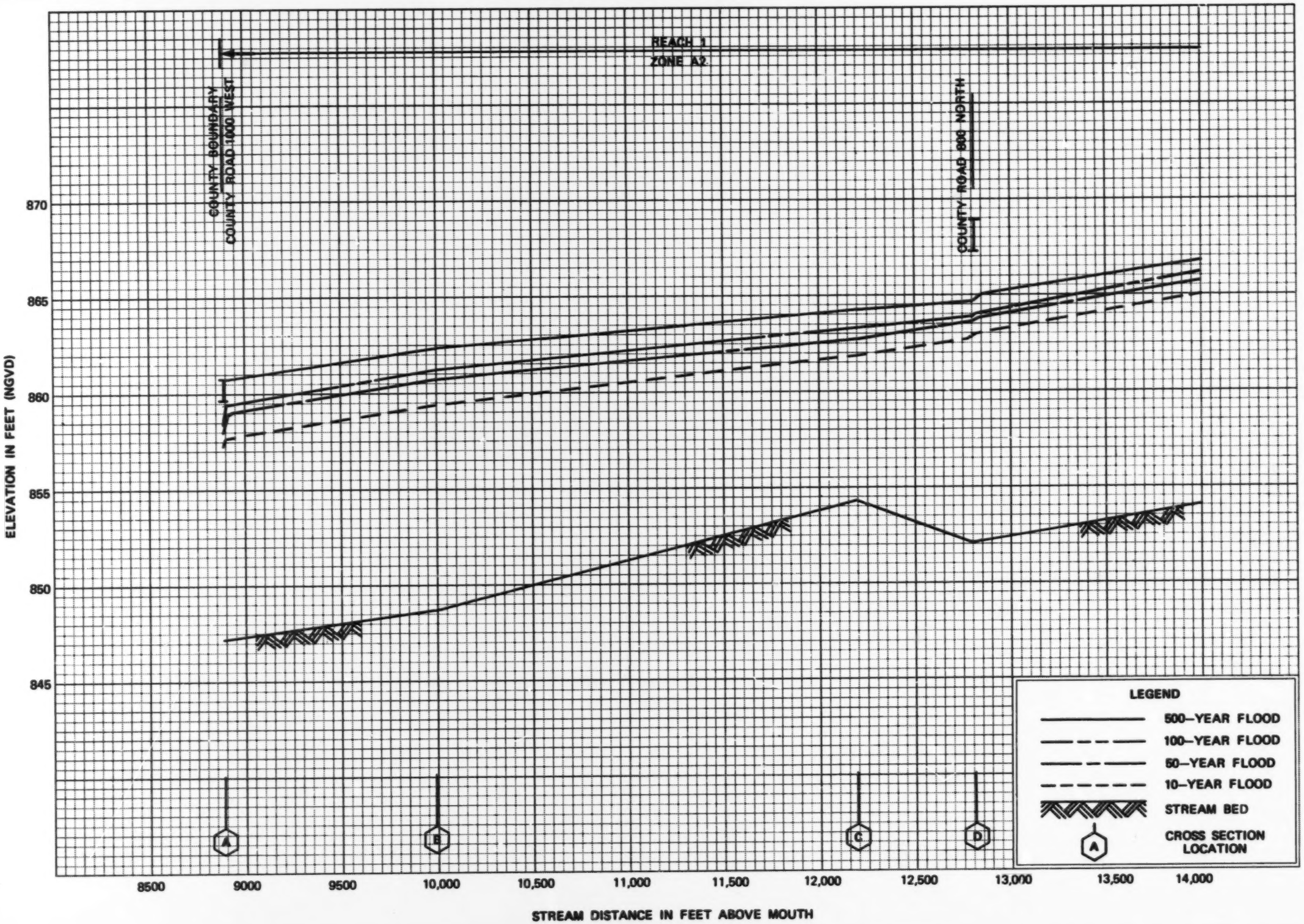
FLATROCK RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

14P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

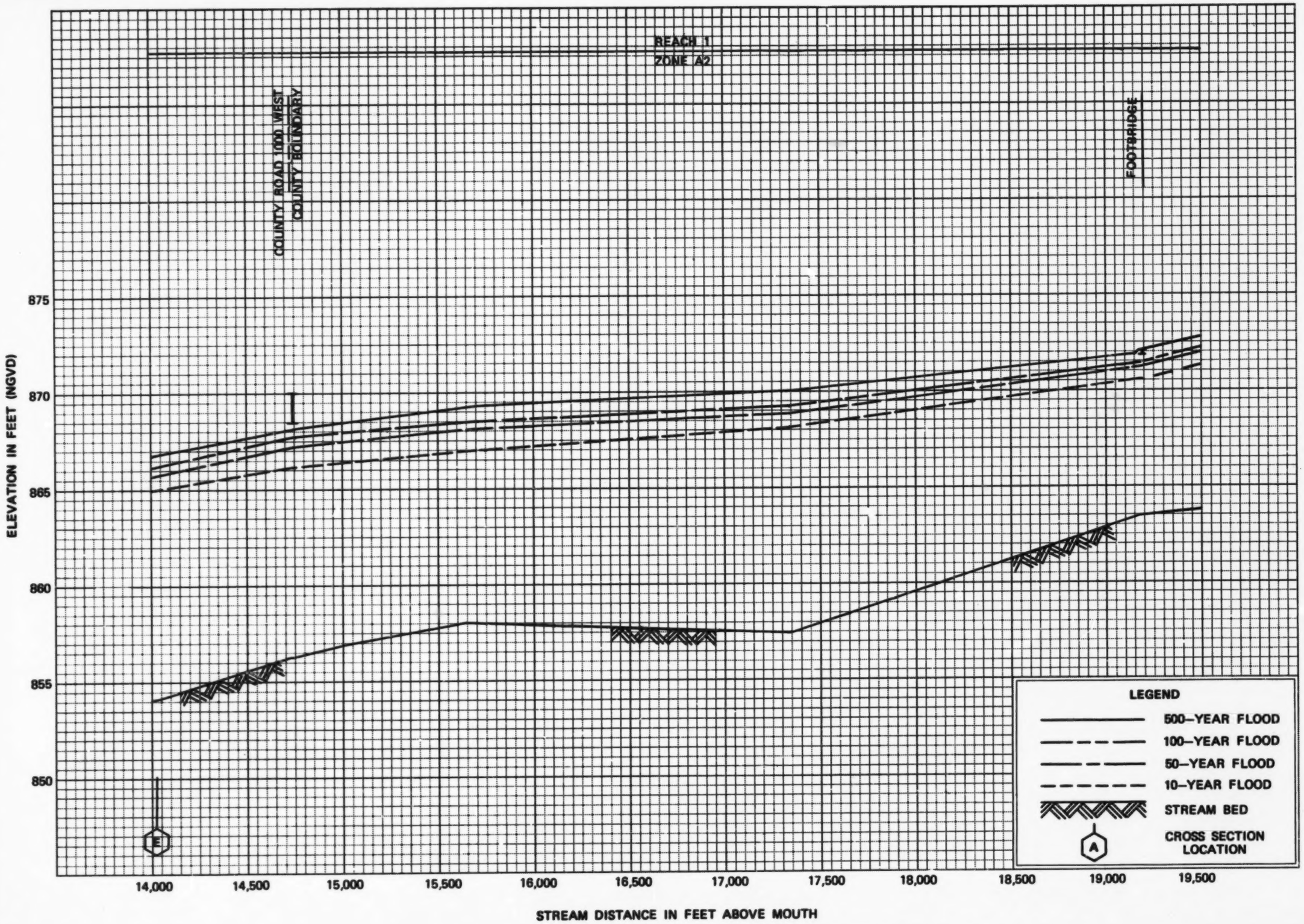
SIX MILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

15P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

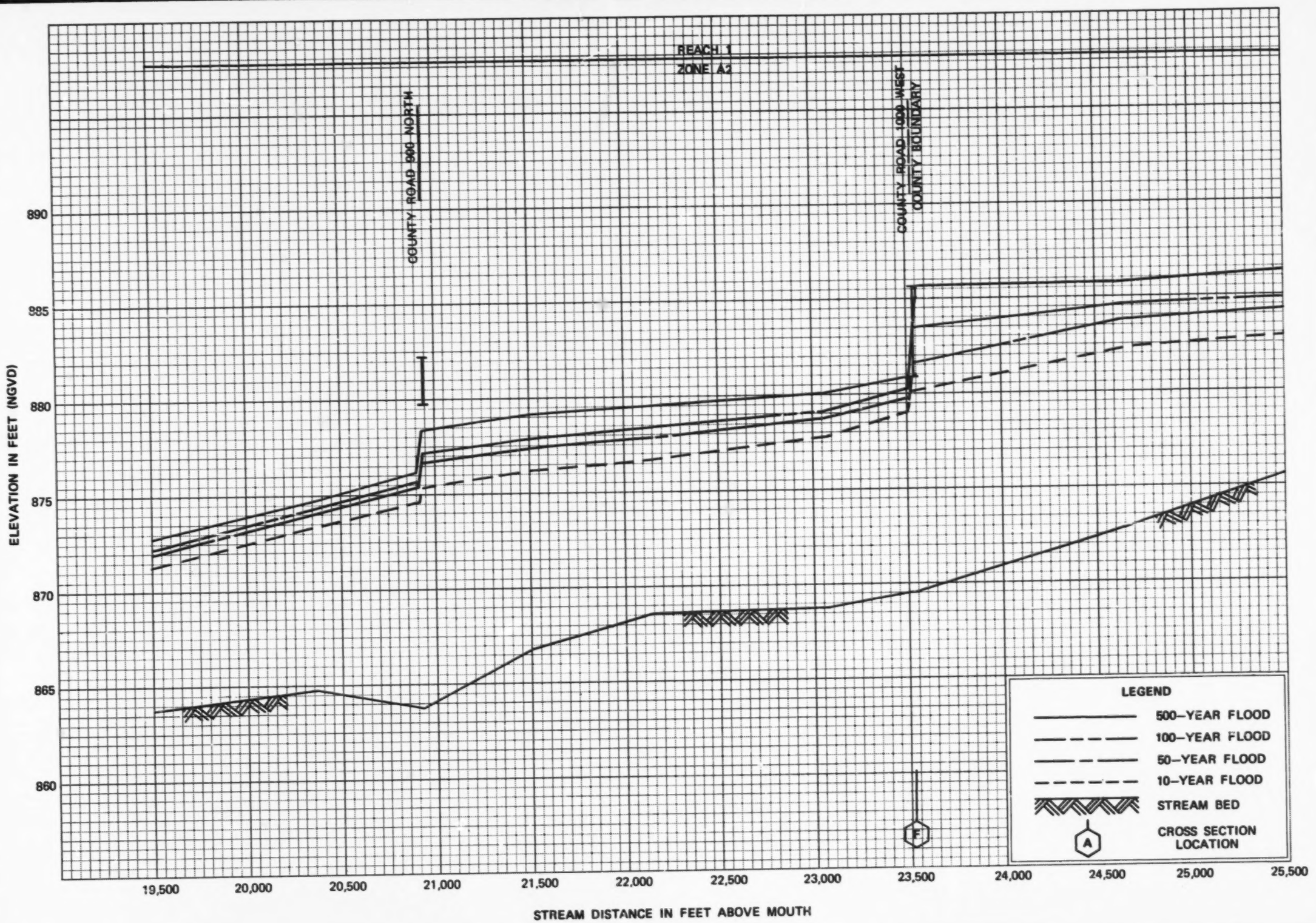
SIX MILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

16P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

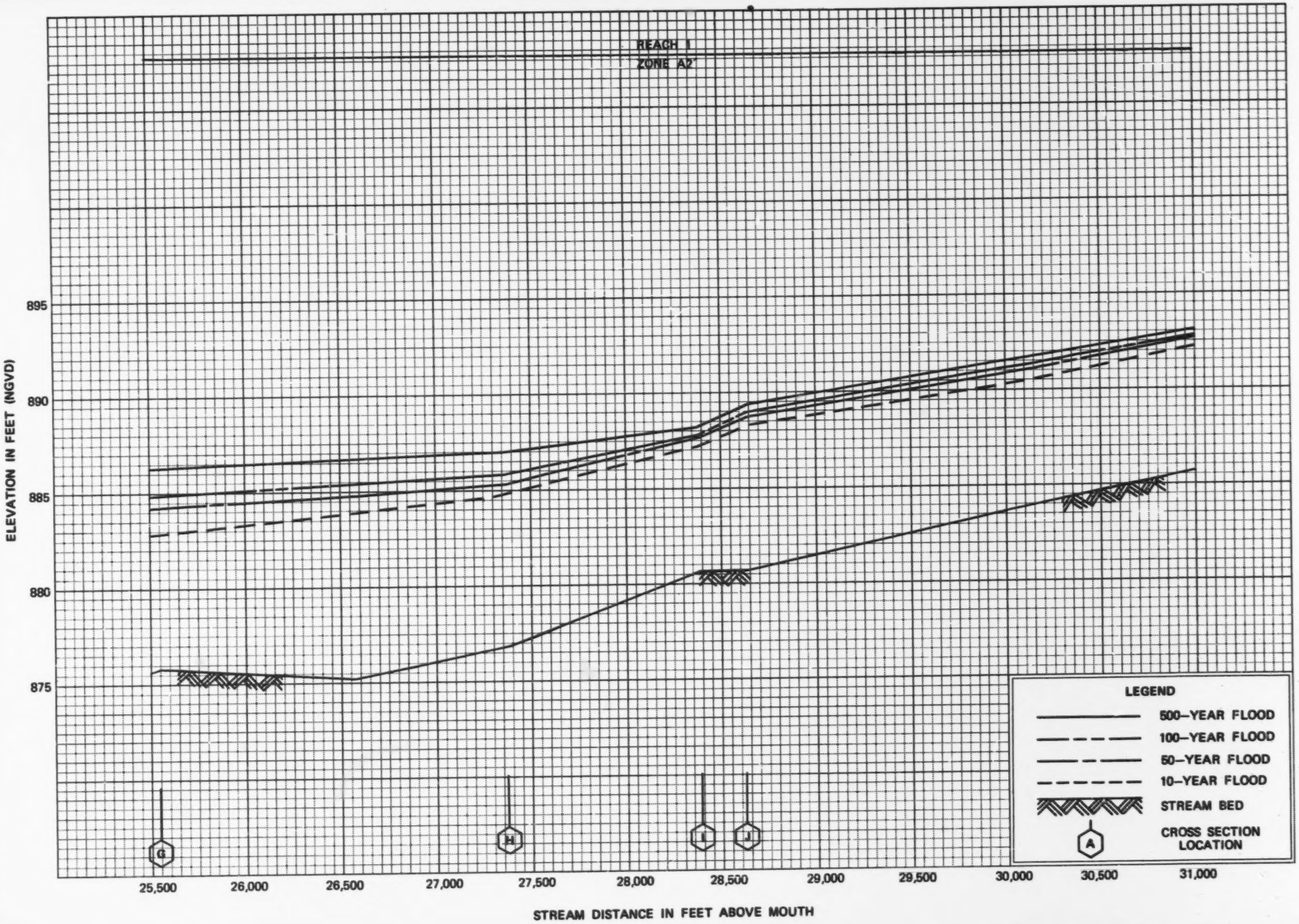
SIX MILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

17P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

SIX MILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

18P

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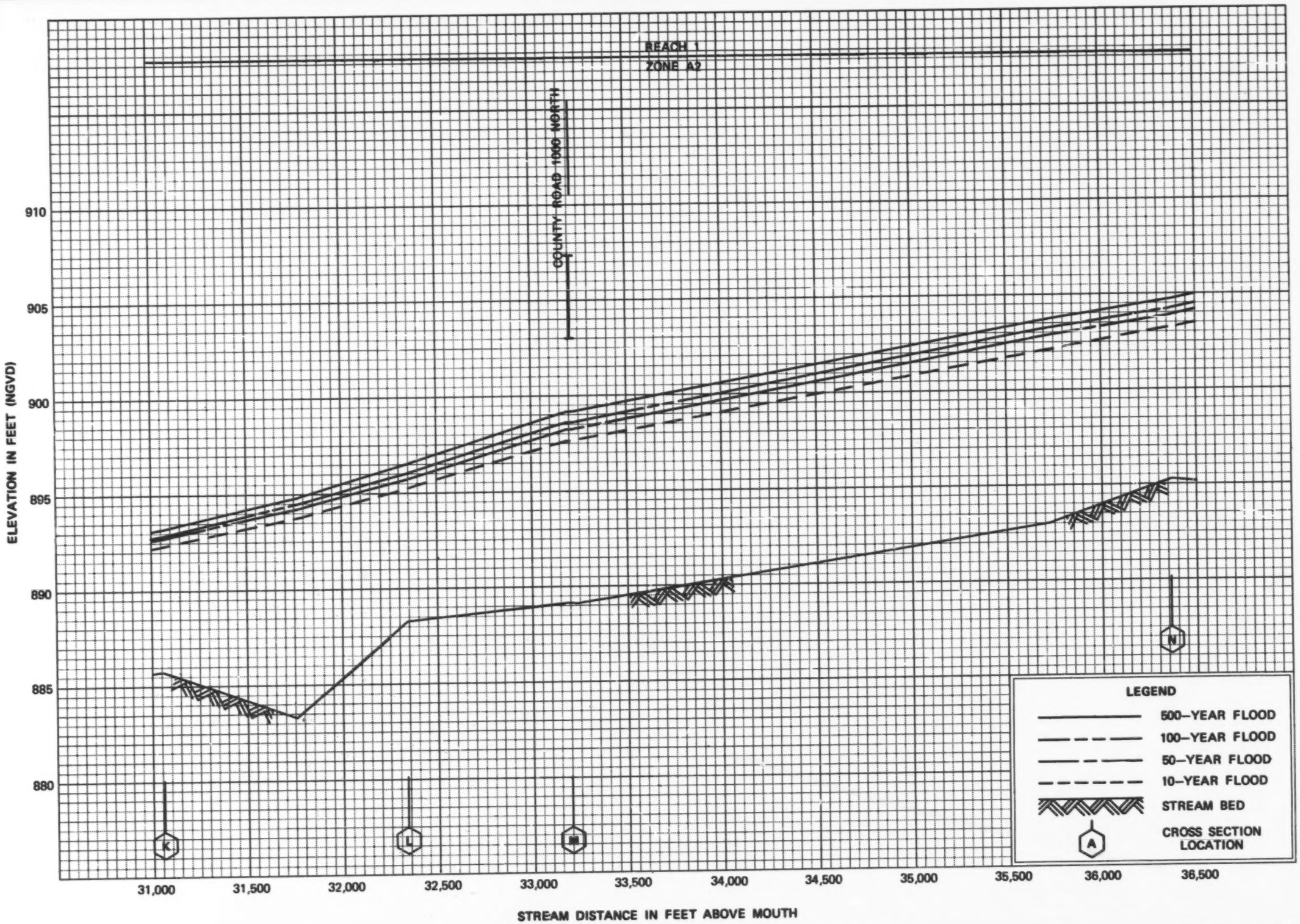


FLOOD PROFILES

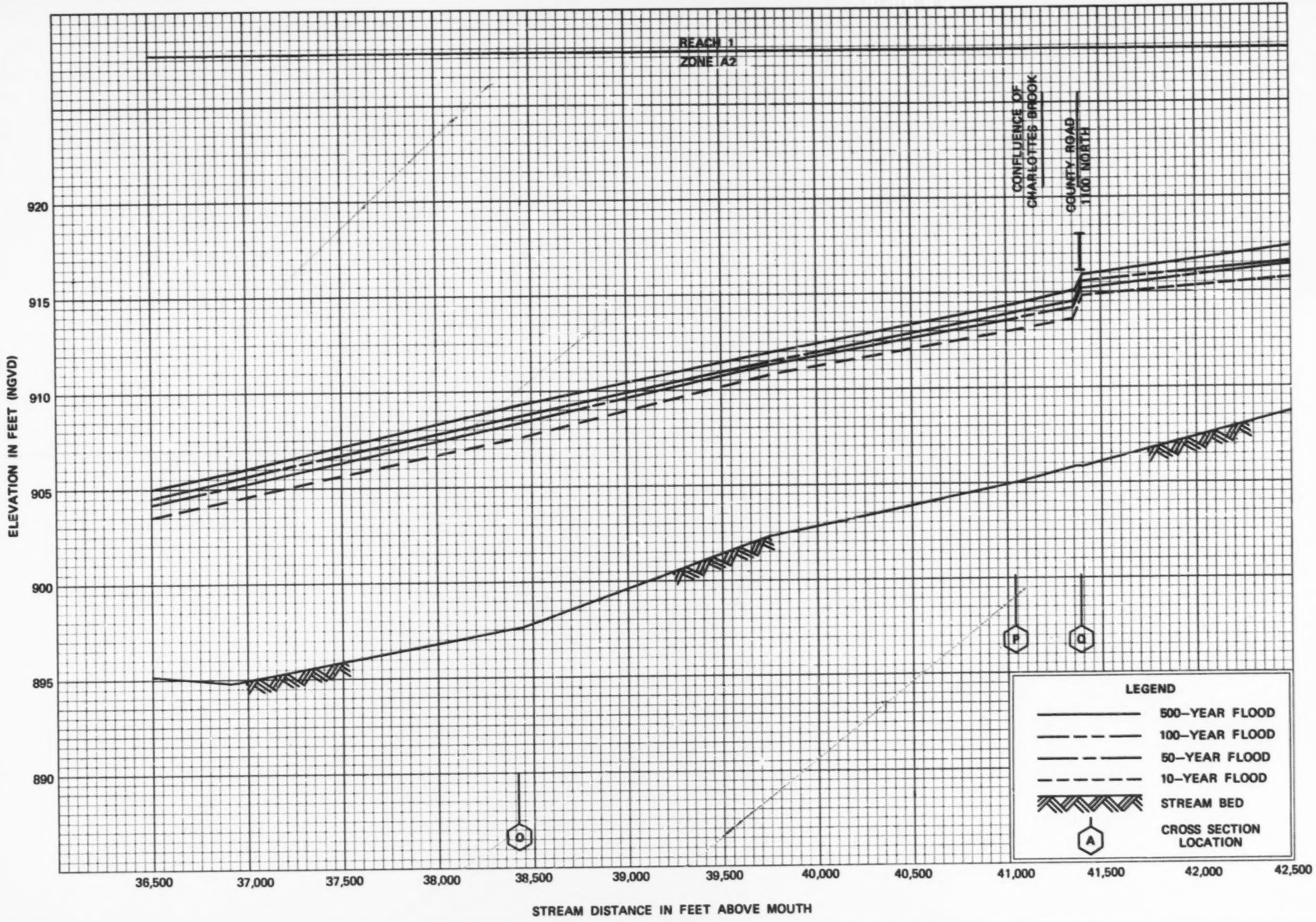
SIX MILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

19P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

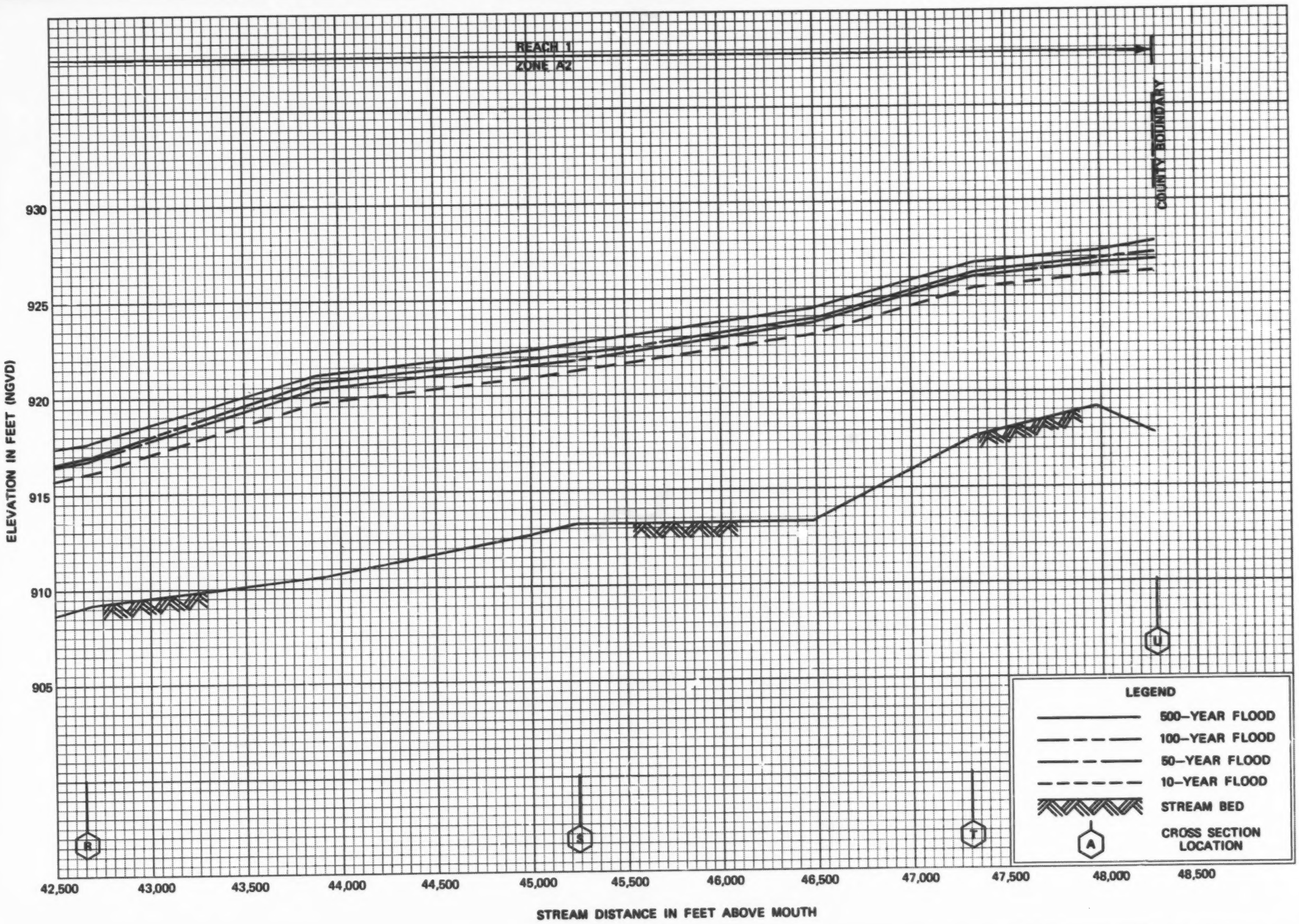
SIX MILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

20P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

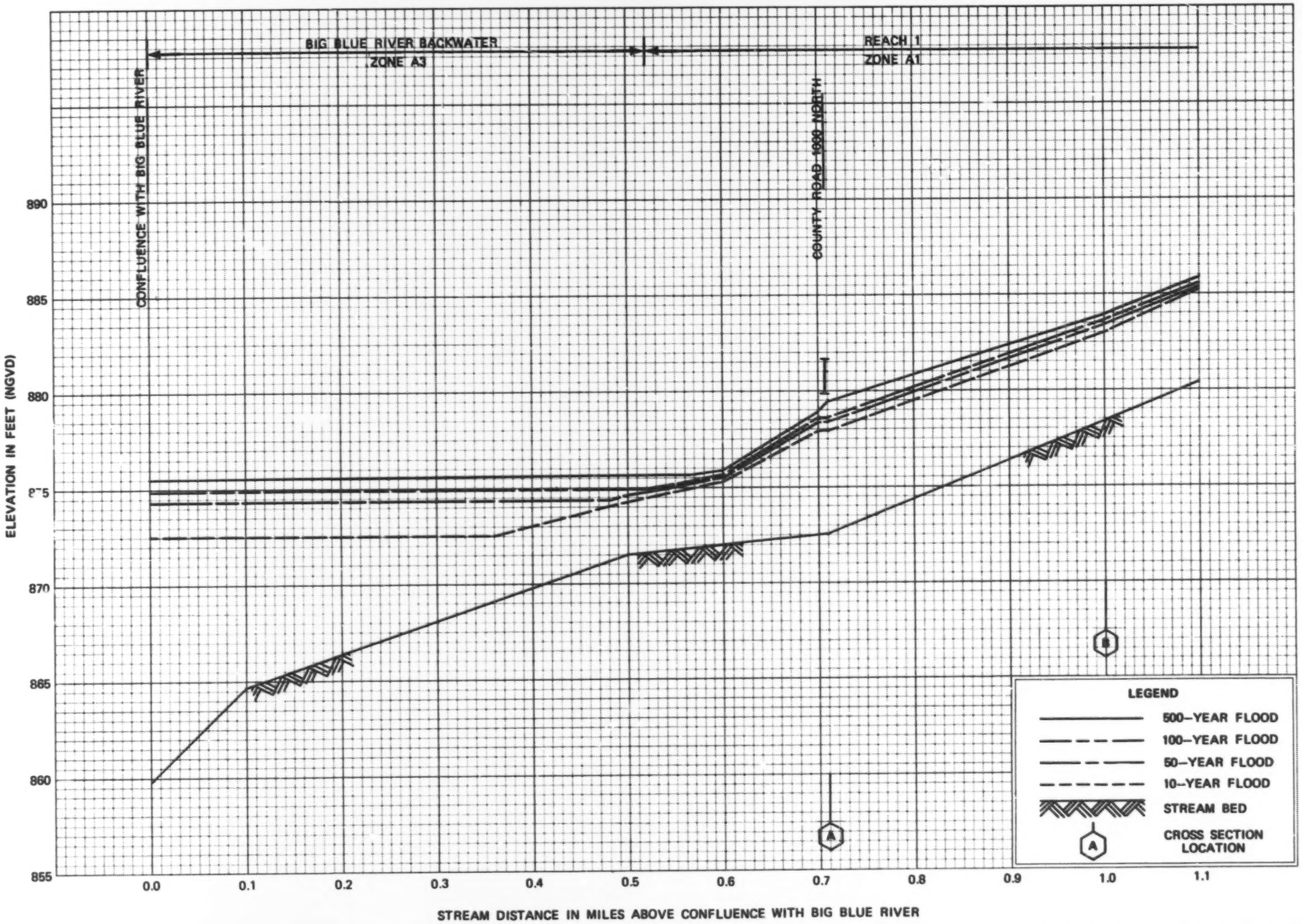
SIX MILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

21P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

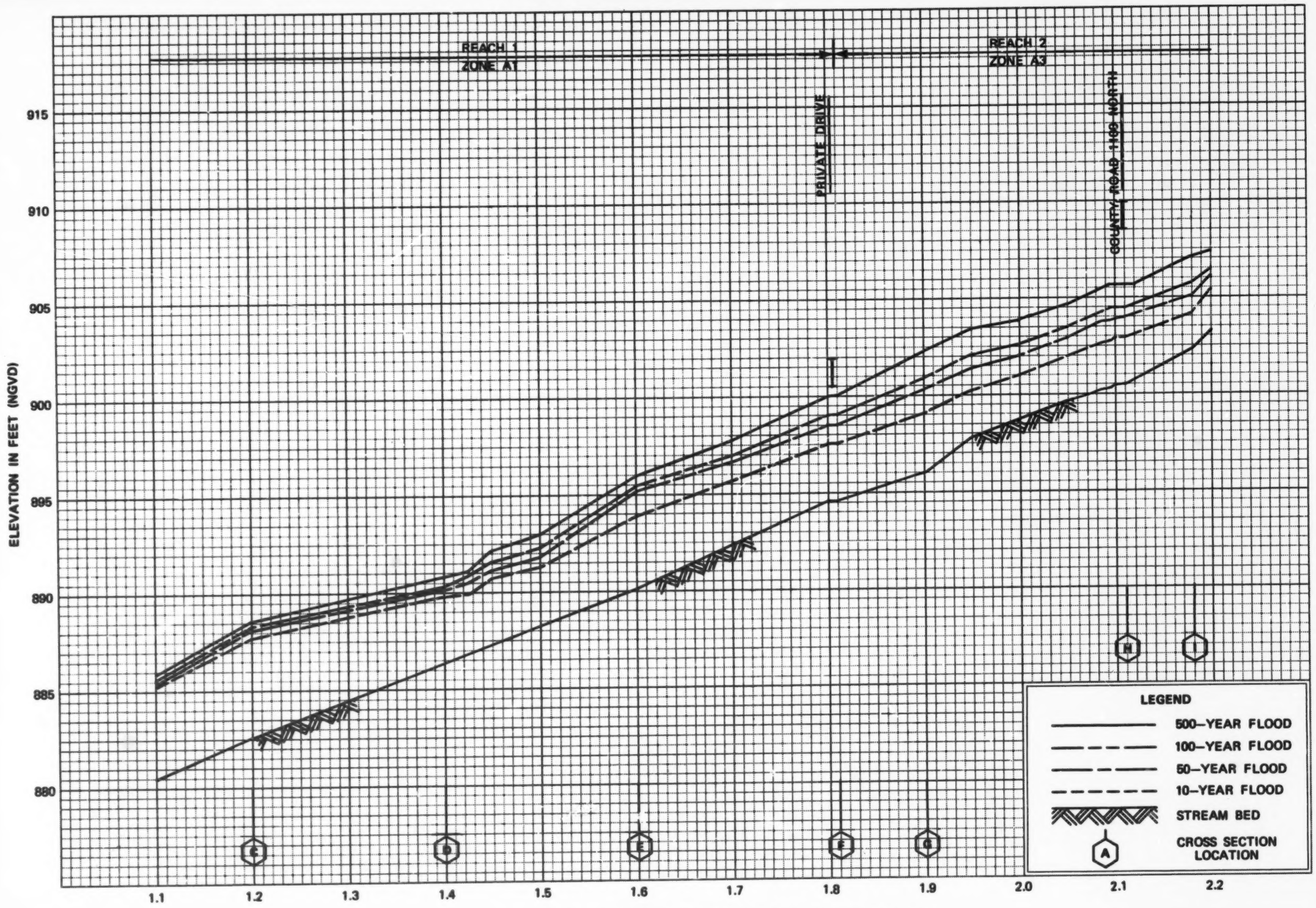
GOOSE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

22P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

GOOSE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

23P

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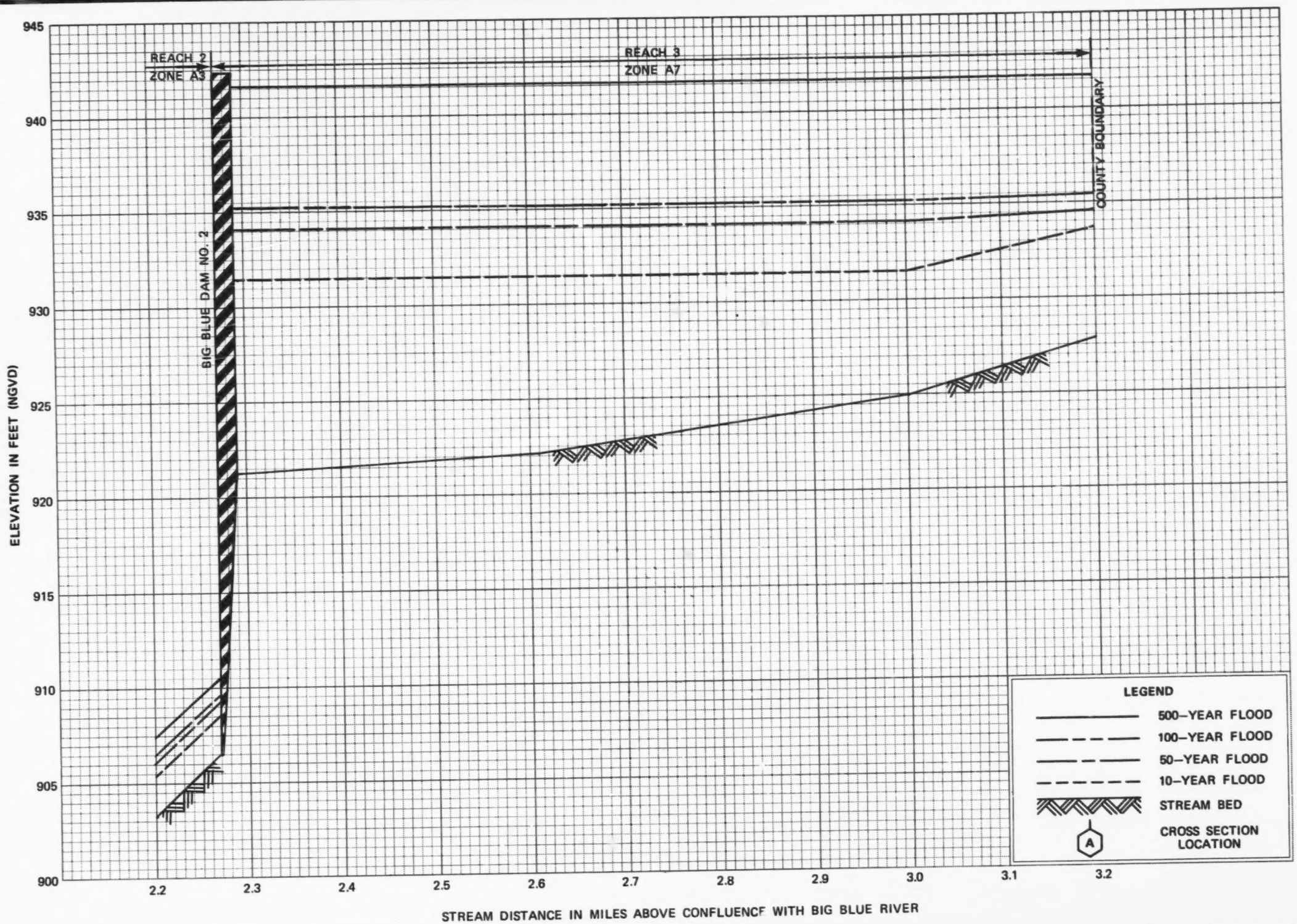


FLOOD PROFILES

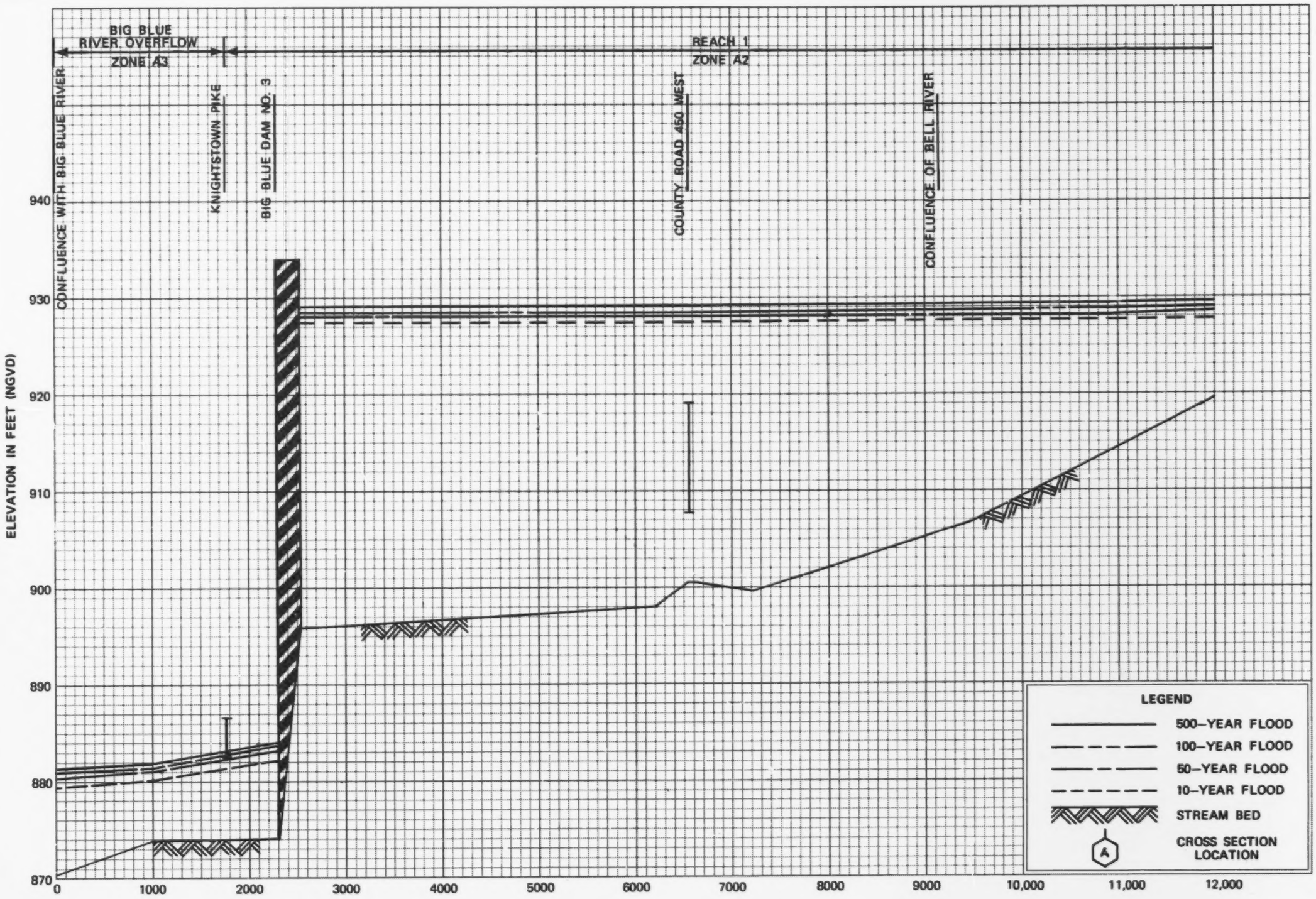
GOOSE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

24P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

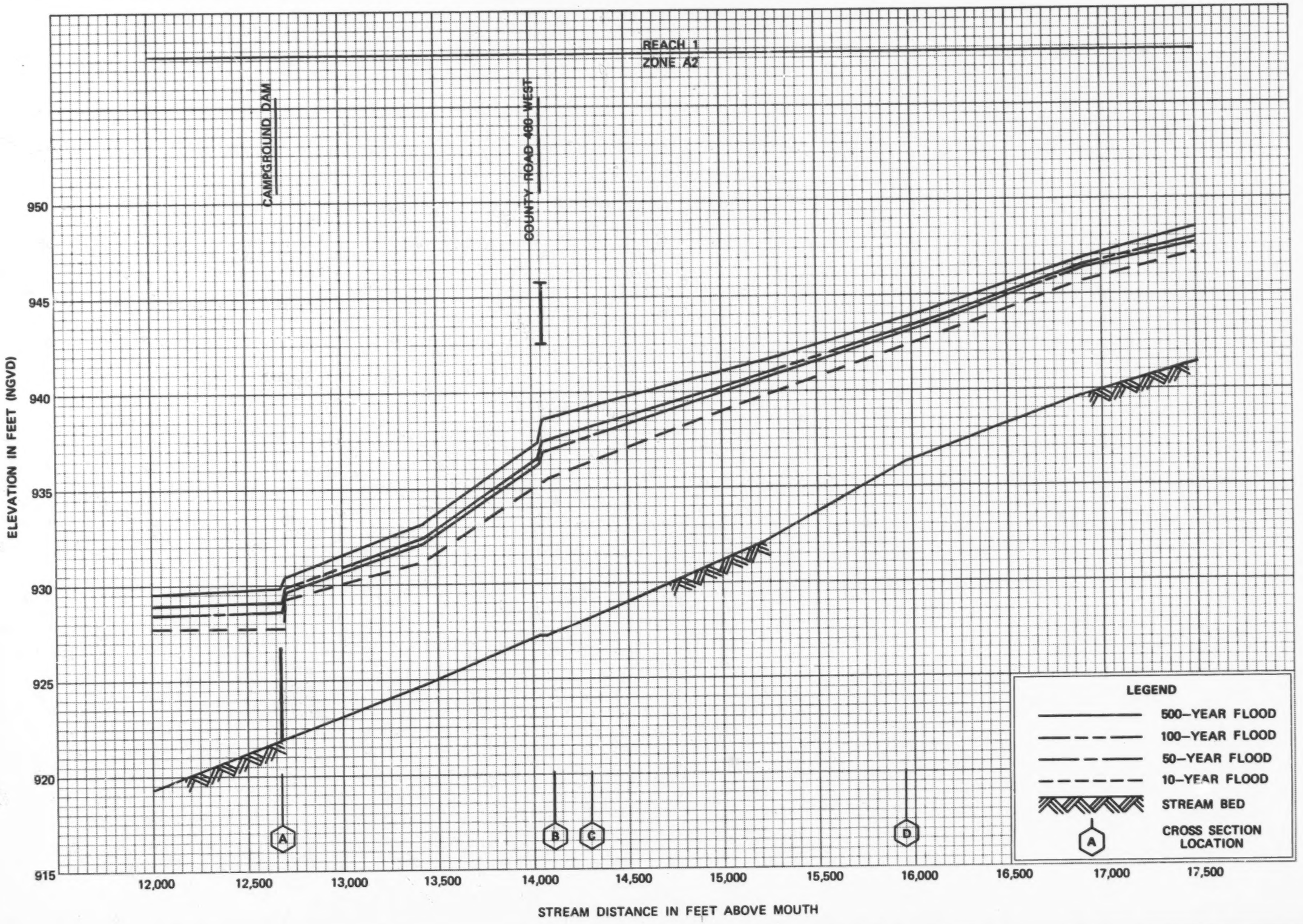
THREE MILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

25P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

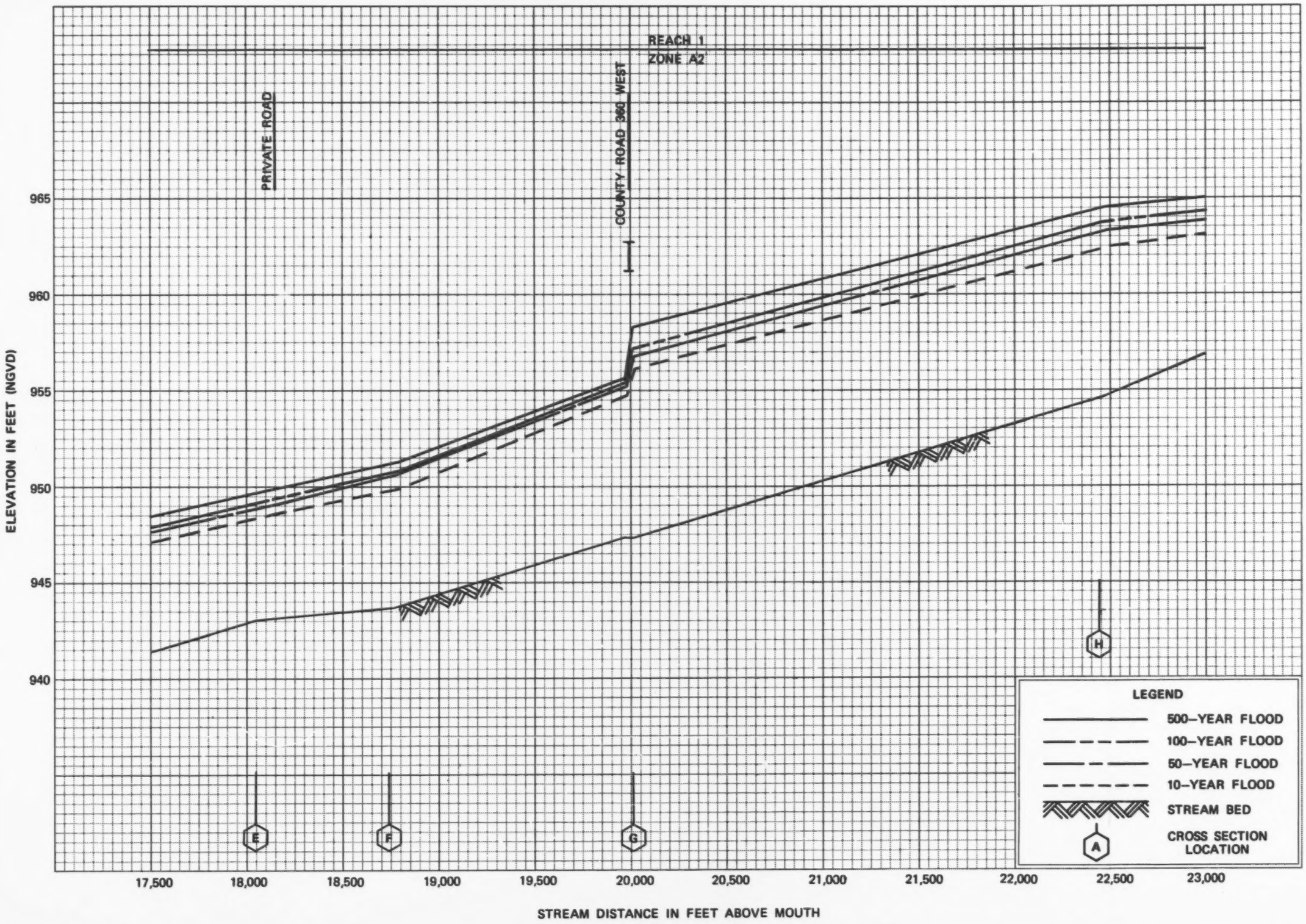
THREE MILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

26P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

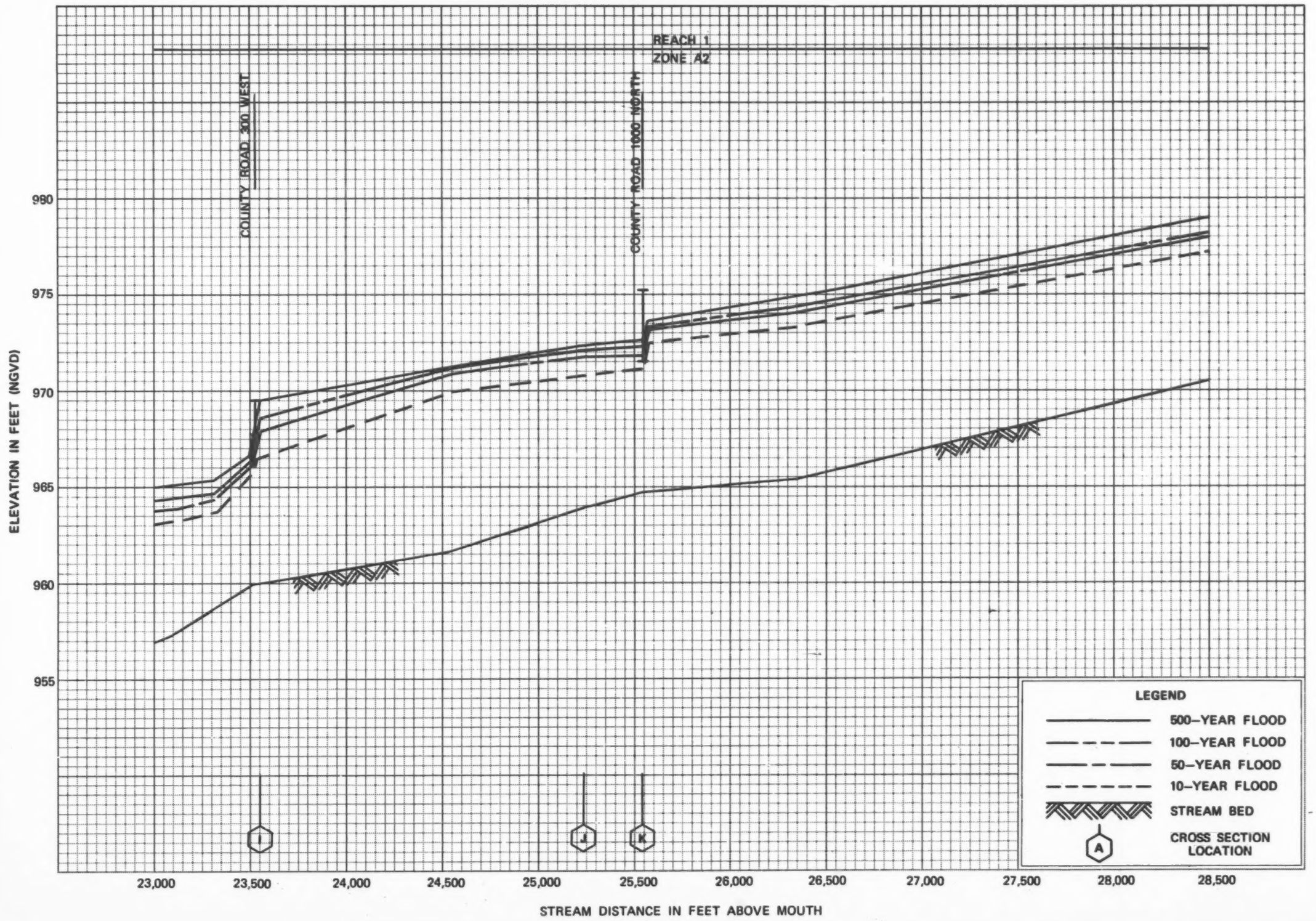
THREE MILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

27P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

THREE MILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

28P

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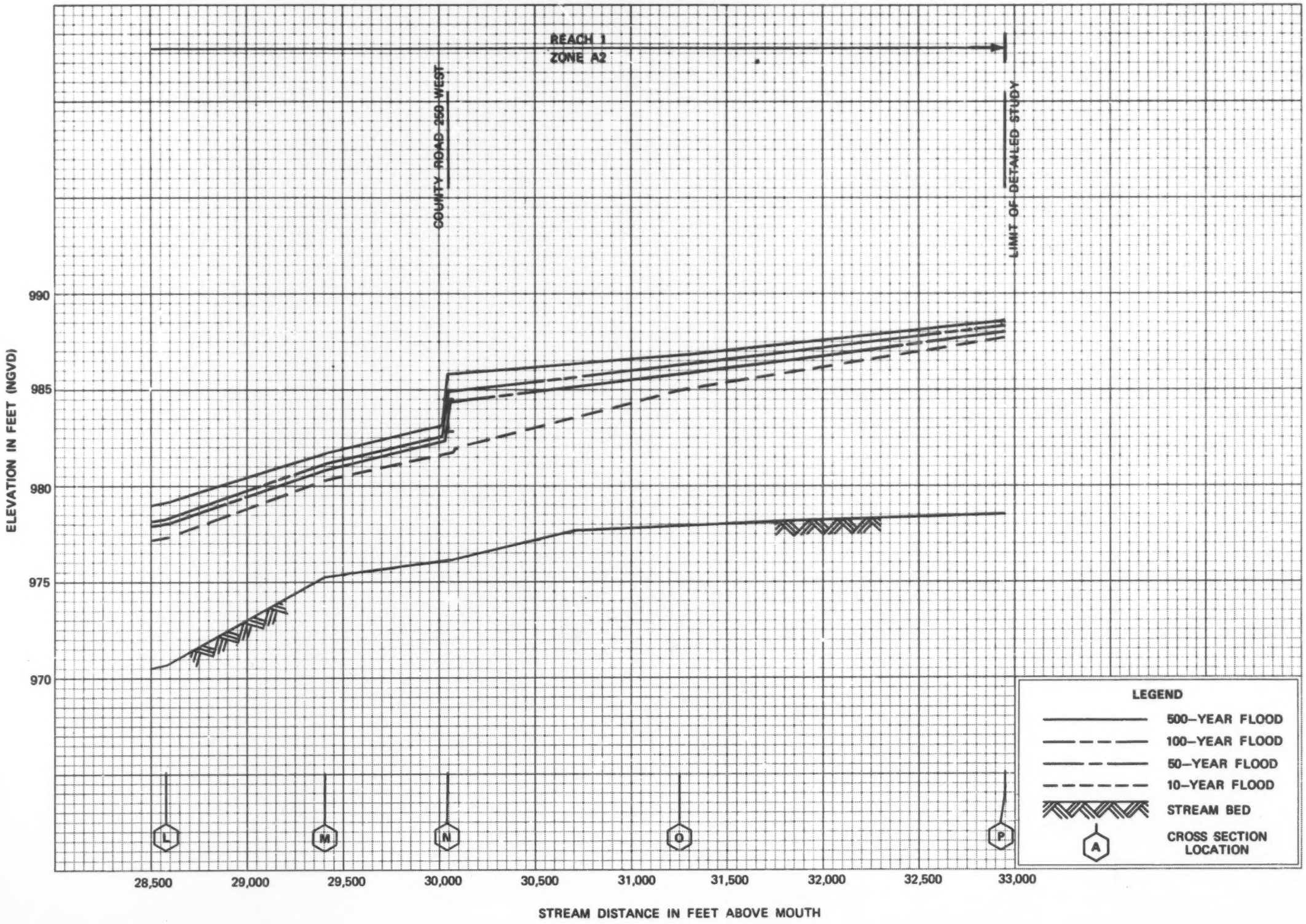

FLOOD PROFILES

THREE MILE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

29P

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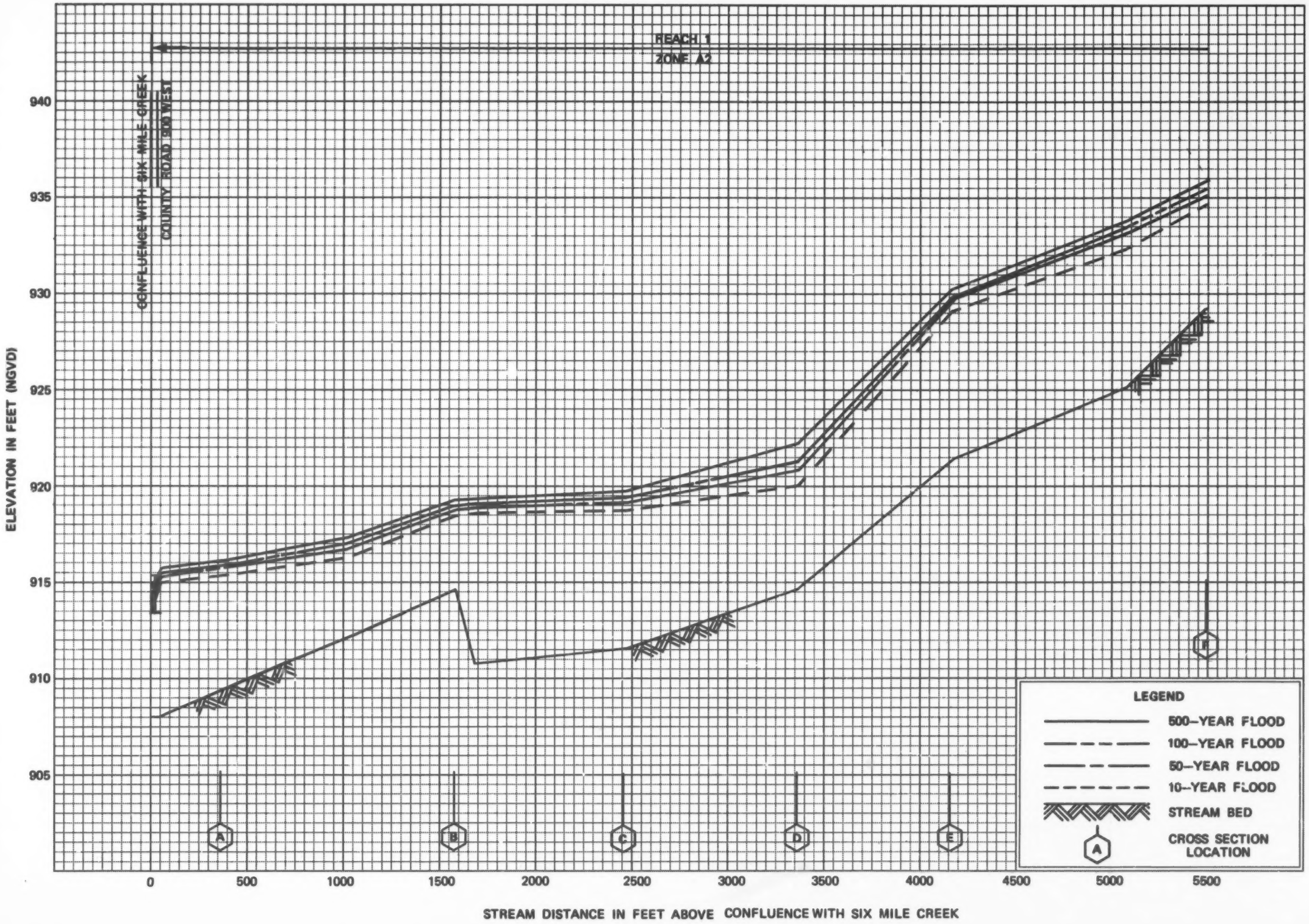


FLOOD PROFILES

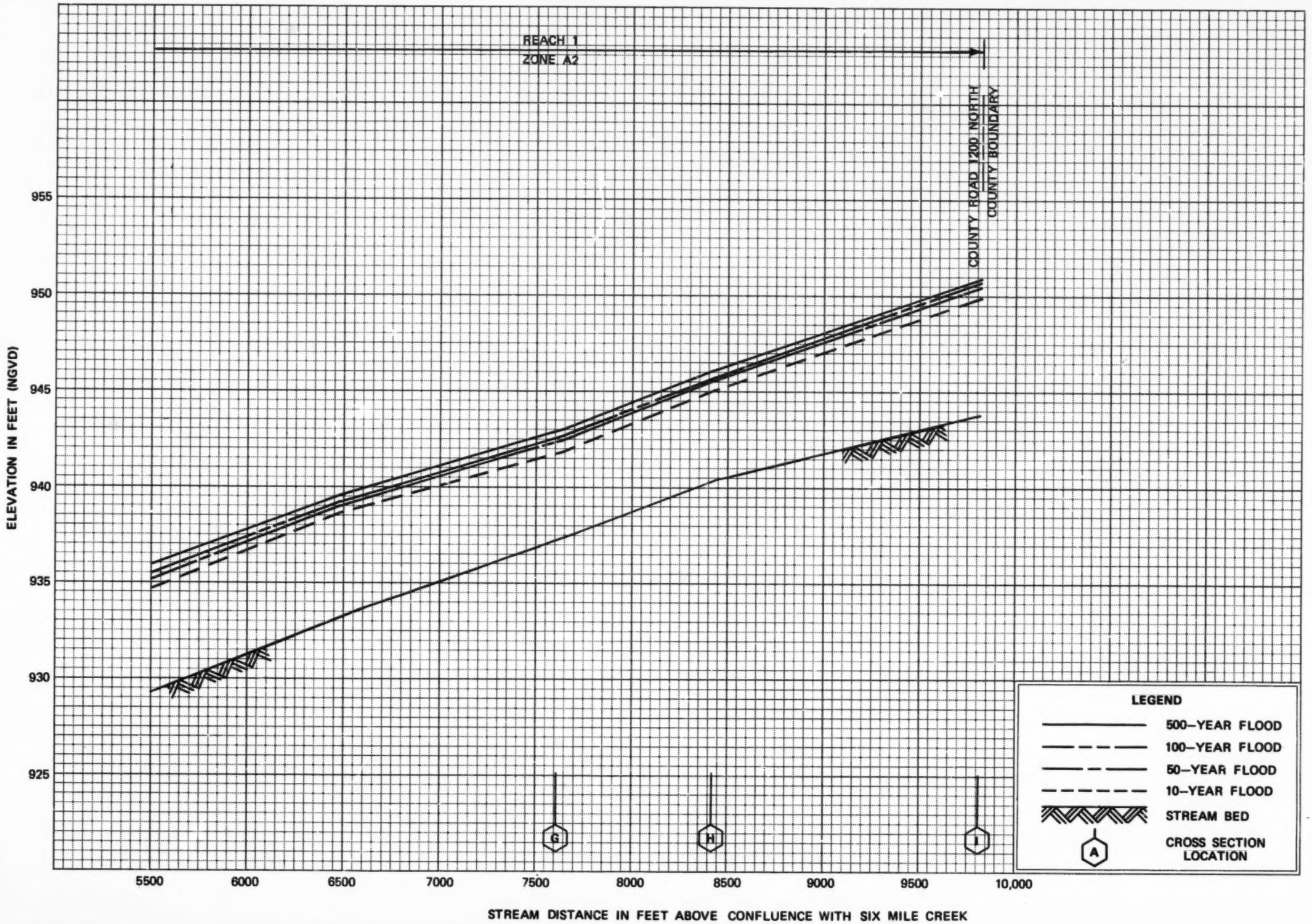
CHARLOTTES BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

30P

BEST DOCUMENT AVAILABLE



FLOOD PROFILES

CHARLOTTES BROOK

FEDERAL EMERGENCY MANAGEMENT AGENCY

COUNTY OF RUSH, IN
(UNINCORPORATED AREAS)

31P